DOCUMENT RESUME

ED 273 235 HE 019 651

AUTHOR Zammuto, Raymond F.
TITLE Organizational Adaptation: Managing in Complexly Changing Environments.
INSTITUTION National Center for Higher Education Management Systems, Boulder, Colo.
PUB DATE Nov 84
NOTE 115p.
PUB TYPE Reports - Descriptive (141)

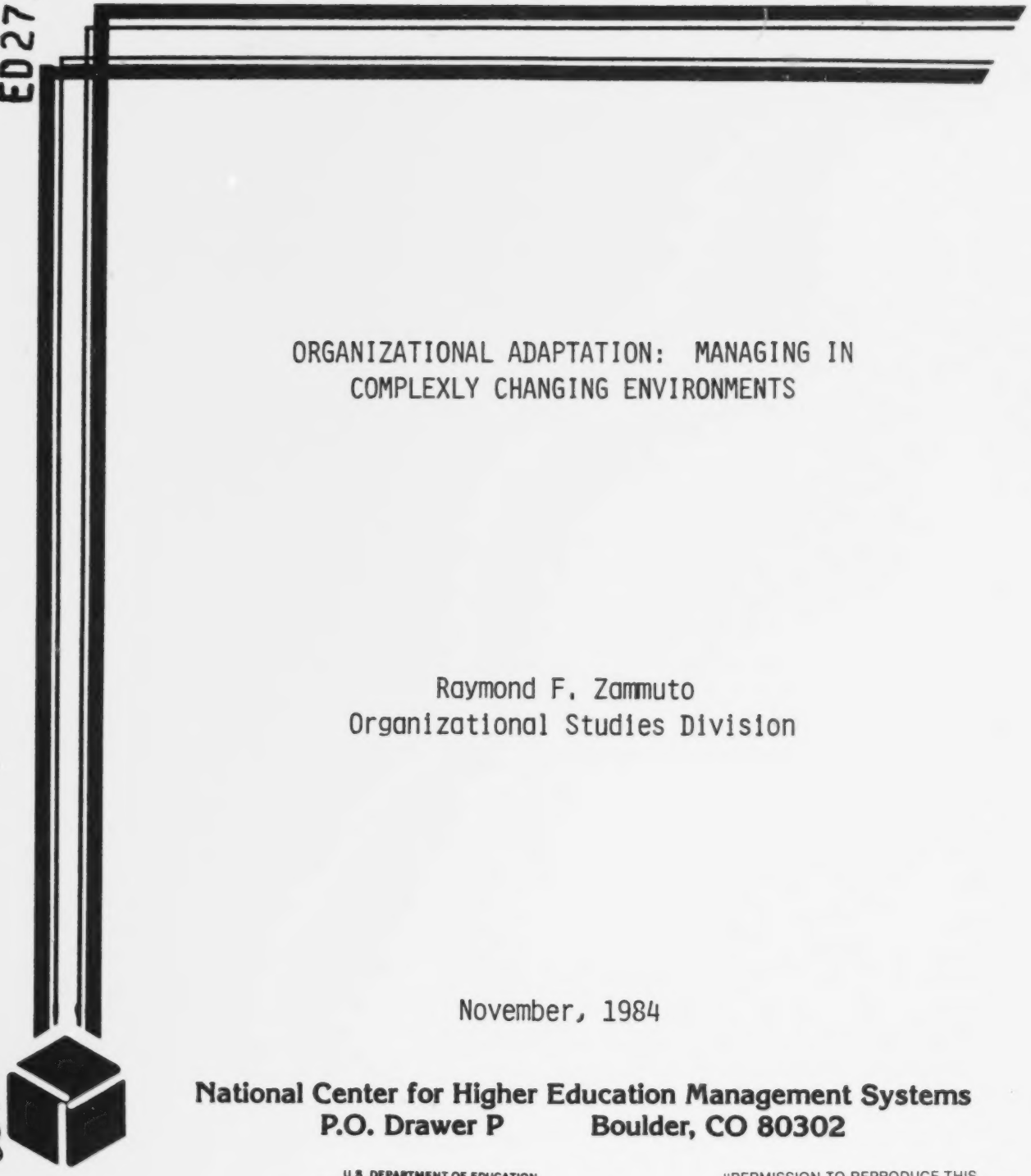
EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS *Change Strategies; *College Administration; *College Environment; Competition; Higher Education; Models; *Organizational Change; Organizational Theories; Policy Formation; *School Effectiveness

ABSTRACT

A model of strategic adaptation that focuses on how organizations adapt to both conditions of growth and decline is presented. The theoretical structure underlying the model is considered, with attention to organizations, niches, and environments, as well as environmental change and evolving niches. The model attempts to reconcile the perspectives of environmental determinism and managerial choice. The importance of the interplay of population characteristics that define an ecological niche is considered, including competition with the niche and organization types (e.g., entrepreneurs and prospectors, defenders and analyzers). The dynamics of adaptation at the population and organizational levels of analysis are covered in outline form. The role of individuals in formulating and implementing strategic organizational responses to changing environmental conditions is also addressed, with attention to the impact of perceptions and attributions in the adaptation process, and the role of leaders. The concept of interpretive strategy as an important factor in the formulation and implementation of effective strategies is introduced, using research being conducted by the National Center for Higher Education Management Systems. (SW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED273235



ORGANIZATIONAL ADAPTATION: MANAGING IN COMPLEXLY CHANGING ENVIRONMENTS

Raymond F. Zammuto
Organizational Studies Division

November, 1984

National Center for Higher Education Management Systems
P.O. Drawer P Boulder, CO 80302

HE 019 651

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

NCHEMS

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Table of Contents

Organizational Adaptation: Managing in Complexly Changing Environments

	Page
Introductory Note	1
Chapter 1--Outline: Managing in Complexly Changing Environments	3
Chapter 2--Draft: Organizations, Niches, and Environments	6
Chapter 3--Draft: Environmental Change and Evolving Niches	47
Chapter 4--Outline: Adaptation of Organizational Populations	76
Chapter 5--Outline: Adaptation and Individual Organizations	83
Chapter 6--Outline: Orchestrating Strategic Adaptation: The Role of Interpretive Strategy	93
Chapter 7--Outline: Conclusion	96
References	97

INTRODUCTORY NOTE

The following material includes chapter drafts and outlines for the manuscript entitled Organizational Adaptation: Managing in Complexly Changing Environments. This particular project is in a constant state of evolution as new information is incorporated into it. It might even be said that this manuscript on adaptation is in the process of adapting itself to an everchanging ecology of ideas.

The basic theoretical framework underlying the model of adaptation is presented in draft form in Chapters 2 and 3. The dynamics of adaptation at the population and organizational levels of analysis are described in the outlines for Chapters 4 and 5. The information needed to complete the cases that will be used to illustrate the dynamics of the model in these chapters is currently being assembled. Chapter 6 shifts the level of analysis to the role of individual perceptions and attributions in the adaptation process. This chapter also introduces the concept of interpretive strategy as an important factor in the formulation and implementation of effective strategies. Research currently being conducted by the Organizational Studies Division will be the basis for this part of the adaptation model.

Creating this model is an ambitious project. As can be seen above, three different levels of analysis--population, organization, and individual--are being examined. Moreover, the model attempts to reconcile at least part of the longstanding debate within the organizational sciences about whether organizational form and function is environmentally-determined as opposed to reflecting strategic choice. The success of this project is dependent upon careful comment

and criticism by other knowledgeable people within the field. Initial drafts will be circulated this winter to obtain such information.

Writing and revision of the manuscript will continue throughout the following year. As the manuscript nears completion, publication opportunities will be explored with the intent of reaching the widest audience possible.

Chapter 1: Outline

MANAGING IN COMPLEXLY CHANGING ENVIRONMENTS

The purpose of the introductory chapter is to discuss why adaptation is an important topic, how it differs from past literature on organizational strategy, and to explain the rationale for the type of model of strategic adaptation that will be developed in the following chapters.

Why a book on adaptation?

The historical emphasis in the administrative sciences on the management of growth is giving way to a broader perspective as the conditions that favored uninterrupted social and economic expansion since the end of World War II dissipate. A clear example of this is provided by the change in the mixture in the administrative science literature over the past few years. Prior to 1977, very few articles or books had been published concerning the management of decline; most of the literature focused on the management of growth. Since then, over 400 articles, papers, and books have appeared on the management of decline in the organizational science, public administration, and higher education literatures (Zammuto, 1984a).

The literature clearly indicates that managing decline is not simply the reverse process of managing growth. Marked differences have been found in a number of organizational processes under the two conditions, including differences in leadership practices, decision making, organizational climate, morale, innovativeness, human resource management, structural adjustments, and so on.

Recognition is increasing that it is normal for an organization to pass through periods of both growth and decline, and that different organizational strategies are required for adaptation to these different conditions. For managers to be fully prepared to guide an organization through the different phases of its existence, they need to understand the dynamics of both growth and decline, and the strategies that are useful in adapting to these conditions. The purpose of this book is to present a model of strategic adaptation that focuses on how organizations adapt to both conditions of growth and decline.

The strategy for discussing organizational adaptation

Organizations must vary their form and function over time in order to adapt to changing environmental conditions. McKelvey (1982) noted that there are two broad categories of models within the organization sciences that differ in their assumptions about how variations in organizational form and function are generated: (1) Autogenic models that view variations in form and function as being caused by individuals within the organizations, and (2) Allogenic models that view variations in organizational form and function as being caused by pressures from the organization's environment. The relationships between individuals, organization, and environment can be characterized as follows:

Individuals ⟶ Organization ⟵ Environment

Autogenic models view the relationship between individuals and the organization as being the predominate source of changes in organizational form and function as the organization adapts to changing environmental conditions, and pays little attention to the role of

environmental pressures. Allogenic models, on the other hand, view environmental pressures as being the major cause of variations in organizational form and function, and little emphasis is placed on the role of the individual in the adaptation process.

We agree with McKelvey's conclusion that an ideal model of the adaptation process would treat both individuals and the environment as causes or sources of variations in organizational form and function. This belief is reflected in the structure of the ideas in this manuscript, which parallel that of the simple diagram shown above. Briefly, the structure of the book can be characterized as follows, where the information in parentheses indicates the component or relationsihp in the model that is the primary concern of each chapter:

Chapter 2: Organizations, Niches, and Environments (E)

Chapter 3: Environmental Change and Evolving Niches ($E \longrightarrow O$)

Chapter 4: Adaptation in Organizational Populations ($E \longrightarrow O$)

Chapter 5: Adaptation and Individual Organizations ($O \longleftarrow I$)

Chapter 6: Orchestrating Strategic Adaptation: The Role of Interpretive Strategy ($O \longleftarrow I$)

Chapter 7: Implications for Management Practice and Theory ($E \longrightarrow O \longleftarrow I$)

Chapters 2 and 3 are presented in draft form. They lay out the basic theoretical structure underlying the model of adaptation presented in the later chapters. Chapters 4 through 7 are presented in outline form. These outlines indicate how the framework developed in the earlier chapters will be used to examine adaptation at the population, organization, and individual levels of analysis.

Chapter 2: Draft

ORGANIZATIONS, NICHES, AND ENVIRONMENTS

The notion of the organizational environment has played a central role in organization theory over the past thirty years, but remains a slippery concept. In the most fundamental sense, the environment has been treated as a residual category in organizational analysis: The environment is everything that is not the organization. Starbuck (1976) noted that the problematic nature of drawing boundaries around organizations, or the task of deciding what is the organization and what is not, has resulted in a significant amount of conceptual disagreement about the nature of the environment. His survey showed that

> Organization theorists have taken at least five approaches...toward describing the environmental elements which have direct immediate effects on organizational behaviors. One group of theorists has emphasized primarily the effects of inter-organizational relations, whereas another group has adopted inclusive viewpoints in which inter-organizational relations are merely a component. Within each of these groups, there have been subgroups differing in the stresses they placed on data obtained from outside observers, and differing in emphases they placed on prescriptive versus descriptive information. These perceptual orientations have further been elaborated into at least twenty terminological variations (Starbuck, 1976: 1082).

For example, some of the common terms used to describe the organizational environment, are domain (Levine and White, 1961), organization set (Evans, 1965, 1966), territory (Child, 1972), and task environment (Dill, 1958).

Even among authors using the same term there is considerable disagreement over definition. For example, the term domain used by Levine and White (1961) and Thompson (1967) refers to the specific activities undertaken by an organization in order to pursue specific goals. In contrast, McWhinney (1968) used the term domain to describe what aspects of the environment are of concern to an organization, should be noticed by it, and used as variables in decision making by organizational leaders. In another view, Normann (1971) and Child (1972) use the term to describe those parts of the environment with which an organization constantly interacts.

Many of the differences in the usage of terms to describe the environment can be attributed to the extent that organizational theorists have viewed the environment as being an organizationally-defined as opposed to an externally-imposed phenomenon. In the first case, the environment is defined as perceived by members of an organization, while in the latter the environment is defined as viewed by an external observer. In essence, this is the often made distinction between subjective and objective definitions of the environment, which lead to very different substantive views of the concept. For example, Tosi, Aldag, and Storey (1973) examined whether perceived environmental uncertainty was the same as uncertainty measured by "objective" or secondary data sources. They compared perceived uncertainty scores obtained from the Lawrence and Lorsch (1969) uncertainty scale from managers in 10 industries with measures of environmental volatility constructed from secondary data sources for those same industries. The results showed that the relationships

between these "subjective" and "objective" measures of the environmental uncertainty concept were weak and inconsistent.

Another aspect of the subjective-objective issue is the extent to which theorists see the environment as being created by versus imposed on an organization. During the 1960s, contingency theorists (e.g., Burns and Stalker, 1962; Thompson, 1967; Lawrence and Lorsch, 1969) generally viewed the environment as given, something to which an organization had to adjust. But by the late 1960s, other theorists began to suggest that the environment was largely created by the organization through processes such as enactment (Weick, 1969) and strategic choice (Child, 1972).

Both perspectives have currency within the literature today, and are usually treated as competing points of view on organization-environment relations (Astley and Van de Ven, 1983) within the context of the debate on environmental determinism versus managerial choice. Organizational ecologists, such as Hannan and Freeman (1977), Aldrich (1979), and McKelvey (1982), are usually associated with the environmental determinism perspective as are later works in contingency theory (e.g, Lawrence and Dyer, 1983). On the other side, authors such as Pfeffer and Salancik (1978), Miles and Snow (1978), and Miles (1982) have argued that managerial choice shapes the environment.

The purpose of this chapter is not to argue that either perspective is right or wrong. Rather, it is to show that they are both right and wrong. Each perspective is incomplete but addresses aspects of organization-environment relations not easily accessible to the other. This argument is made through the development of a model

that shows how managerial choice is both constrained by and shapes the environment. It is a two-stage discussion that begins with a model of organizational environments based on the concept of the ecological niche. The discussion then shifts to the level of organization-environment relations and tackles the question of why the "environments" of similar organizations may or may not be similar. Finally, the model is used to create a typology of environmental change that explains why conditions of growth and decline may be present simultaneously for a population of similar organizations, and why similar organizations may choose different strategies for adapting to changing environmental conditions. In essence, the proposed model is an ambitious attempt to reconcile the perspectives of environmental determinism and managerial choice into one theoretical statement about organizations and their environments. This particular chapter lays the groundwork by examining the notion of an ecological niche and associated concepts.

THE ECOLOGICAL NICHE

The term niche is not new to organization theory. Starbuck and Dutton (1973), for example, used the term to describe an environmental configuration that facilitates the survival of one organizational species. The term also has been used by organizational ecologists to refer to "combinations of resource levels at which the population can survive and reproduce itself (Hannan and Freeman, 1977: 947)." But even the use of the niche concept in organizational ecology, which is based on the biological literature, has not focused on it as a way of modeling the environment. Rather the concept has been used as a premise from which population dynamics can be studied. For this

reason, the following section traces out the development of the concept of an ecological niche in the biological literature on population ecology, and describes some of the fundamental aspects of niche theory.

Origins of the Concept

The introduction of the concept of an ecological niche into biology is usually attributed to Grinnell (1917) and Elton (1927), each of whom defined the concept in a different manner. Grinnell (1917: 427) used the term to signify "the ultimate distributional unit, within which each species is held by its structural and instinctive limitations." As such, Grinnell's niche referred to the potential area in which a species could live. Elton (1927: 64) independently developed a different formulation of the niche concept that was concerned with ecological function; that is, the relationship of a species to its environment. He defined an animal's niche as "its place in the abiotic environment, its relation to food and enemies," which is distinguished from Grinnell's niche in its reference to the organism's actual rather than potential place in nature.

Vandermeer (1972) suggests that much of the growing popularity of the niche concept in biology between 1930 and 1950 was the result of work conducted on competition by individuals such as Lotka (1925), Volterra (1928), and Gause (1934). Collectively, their work led to the "principle of competitive exclusion" (Hardin, 1960), which roughly states that no two species can occupy the same ecological niche. By the 1950s, Grinnell's and Elton's concepts of ecological niche had become "somewhat amalgamated and the vague notion of ecological niche as an organism's profession within an ecological community became accepted in virtually all textbooks of ecology (Vandermeer, 1972:

108)." But at the same time, it was becoming apparent to many biologists that the ecological niche concept was excessively vague. It was in this context that G. Evelyn Hutchinson (1957) developed the formal notion of the ecological niche as a hypervolume in time and space, a concept that formed the basis of much of the subsequent theory and research in ecology.

Simply stated, if you start with two independent environmental dimensions and identify the limiting values within which a species can successfully reproduce, a rectangular area will be defined. (Hutchinson assumed independence between niche dimensions to facilitate the presentation of the niche concept.) Subsequent work in ecology has relaxed this assumption, the implications of which will be discussed in the next chapter. Each point of the rectangular area corresponds to an environmental state in which the species can survive. As other physical or biological environmental dimensions are added to the model the two-dimensional surface becomes a hypervolume. Every point within the volume represents a set of conditions in which the species can survive indefinitely. Hutchinson labelled this area the fundamental niche of a species, which corresponds to the range of conditions in which the species can survive in the absence of interactions with other species. Hutchinson then defined the realized niche as the area within the hypervolume that a species does inhabit when interactions with other species are taken into account.

An important facet of the hypervolume concept was that it integrated the ideas of both Grinnell and Elton into a single model (Vandermeer, 1972). Grinnell's niche could be termed pre-interactive in that it defined the range of physical and biological conditions in

which a species could survive, equivalent to Hutchinson's fundamental niche. Elton's (1927) niche is post-interactive in that it focuses on the actual physical distribution of a species, equivalent to Hutchinson's concept of the realized niche. The Hutchinsonian model envigorated theory and research in ecology and led to a number of refinements in niche theory relevant to the subject of organizational adaptation. The following section applies the concept of an ecological niche as a model of the organizational environment and draws heavily from the literature on ecology.

The Niche in Organizational Ecology

Using the Hutchinsonian model, we can define a niche as an n-dimensional volume in time and space defined by a set of physical, biological, and social conditions that provide resources for or place constraints on the performance of an organizational population (Zammuto and Cameron, 1985). The size of the hypervolume is referred to as the niche's carrying capacity. In biology, carrying capacity is the size of the equilibrium population a niche will support (Boulding, 1978). The carrying capacity of a niche in organizational ecology needs to be defined somewhat differently. In biology, organisms within a population are more or less standardized in terms of their resource usage in the niche space. In organizational ecology, a single large organization may fill a niche; or that niche can be occupied by many smaller organizations, each producing only a portion of what the niche can support (McPherson, 1983). Therefore, the carrying capacity of a niche in organizational ecology is defined as the level of population performance that the niche will support.

The fundamental niche of an organizational population defines the carrying capacity of the niche in the absence of competition with other organizational populations, while the realized niche of the population refers to the niche space actually occupied by organizations within the population after interactions with other organizational populations are taken into account. For example, the fundamental niche of the population of colleges and universities can be defined as consisting of all situations where there is demand for postsecondary educational services. The realized niche of the college and university population is that portion of the niche that those organizations actually occupy, after taking into account the activities of other sources of postsecondary education such as proprietary schools, corporate training programs, continuing education programs offered by park districts, and the like.

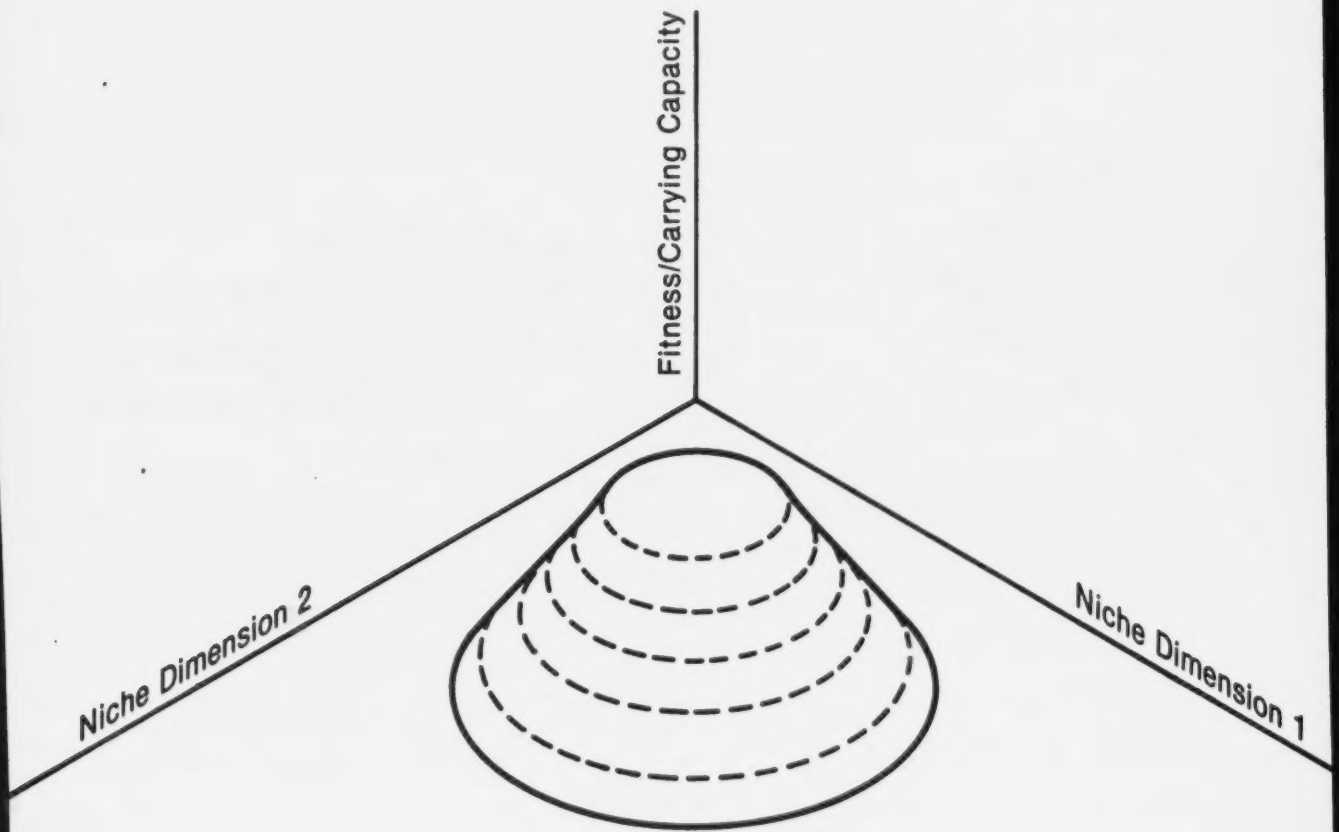
One of the assumptions made by Hutchinson (1957) was that each point within the hypervolume was equally favorable to the continued survival of the population in question. Later work in ecology (e.g., Levins, 1968) relaxed this assumption, noting that some conditions within a niche will be more favorable to a species than others. This notion is referred to as the fitness of a population, which is defined in the biological literature as the ability of a species to perpetuate itself as measured by reproduction (Pianka, 1983). It is obvious that this notion has to be modified in organizational ecology since reproduction is not generally one of the functions of an organization. Assuming that a population must create valued outcomes by producing goods or services in order to survive, its fitness can be defined as its ability to perpetuate itself as measured by production.

Some of the conditions within a niche will be more favorable to a population's ability to produce goods and services than others. As a result, a population will have a greater degree of fitness under some niche conditions than others. Figure 2-1 portrays a population's fitness within a niche. The horizontal axes represent two environmental dimensions defining a niche. The vertical axis represents the fitness of the population across these conditions. Given that fitness has been defined as the ability of a population to produce goods and services, and that carrying capacity has been defined as the level of population performance a niche will support, the vertical axis also can be labelled carrying capacity, assuming that the population's ability to produce is isomorphic with the niche's ability to support organizational performance.

The resulting bell-shaped volume in Figure 2-1 is a graphic representation of a two-dimensional Hutchinsonian niche.[1] The figure indicates that conditions within the niche are optimal at the peak of the volume, which is where the niche will support the maximum level of organizational performance. Conditions for the population become suboptimal with movement toward the edge of the volume. Carrying capacity, by definition, represents the size of the niche, while the configuration of the volume represents the shape of the niche. These two characteristics will figure prominently into our later discussion since changes in niche size and shape create the necessity for organizational adaptation.

[1]Graphic representations of the hypervolume model of the ecological niche are generally bell-shaped because of the relationship between fitness and environmental conditions (Pianka, 1983: 254). Movement away from optimal environmental conditions results in suboptimal conditions. That is, a little more or a little less of a given environmental factor can decrease fitness.

Figure 2-1
Hutchinsonian Model of the Ecological Niche



Population Configuration Within the Niche

Organizations within a population make choices as to what part of the population's niche they will occupy. McKelvey (1982) has referred to the areas occupied by individual organizations as microniches. The sum of microniches of organizations within a population is equivalent to Hutchinson's (1957) realized niche, or the actual niche space the population occupies. It is important to note at the outset that the concept of microniche has a counterpart at the organizational level of analysis--that of the organizational domain.

The concept of an organizational domain was introduced by Levine and White (1961: 597) who, in a study of 22 health organizations, defined domain as "the specific goals an organization wishes to pursue and the functions it undertakes to implement its goals. In operational terms, organizational domain in the health field refers to the claims that an organization stakes out for itself in terms of (1) diseases covered, (2) population served, and (3) services rendered." Thompson (1967: 26) extended this definition to production organizations by substituting "range of products" for "diseases covered," and noted that with this modification "the concept of domain appears useful for the analysis of all types of complex organizations." For our purpose, we define microniche and organizational domain as being equivalent concepts that serve as a linkage between the population and organizational levels of analysis. Given equivalency, we will use the term domain to refer to those parts of the population's niche occupied by individual organizations.

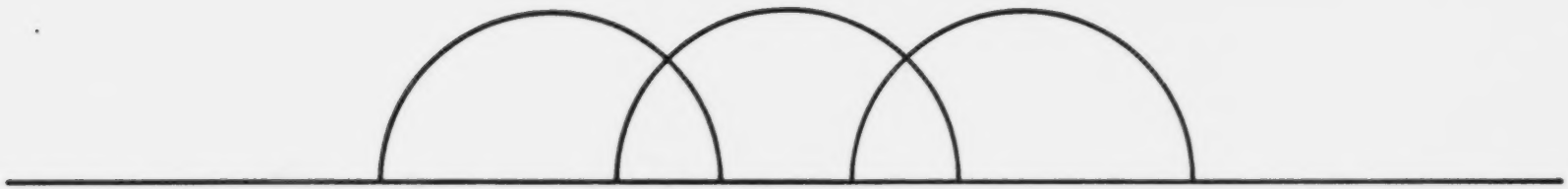
The configuration of the domains selected by organizations within a population has a number of important implications for the model of

adaptation developed in the following chapters. Two characteristics that are important to this discussion are known in the ecology literature as niche width or breadth and niche overlap (Levins, 1968; Colwell and Futuyma, 1971).[2] Niche width refers to the breadth or size of domains that organizations select within the population niche. For example, the organizations in Figure 2-2A have broader domains than do the organizations in Figure 2-2B, in that they each utilize a greater portion of the available niche space. The difference in niche width, or the breadth of organizational domains, is the basis of the distinction between generalist and specialist organizations. Specialist organizations engage in a relatively narrower scope of activities than do generalist organizations (Aldrich, 1979).

The extent to which organizations are specialized and how their domains are distributed create variations in the relative fitness of individual organizational forms within the population niche. The vertical axis in Figure 2-3 represents fitness while the horizontal axis is a niche dimension. Each of the curves represents an organizational form within the population. Organization B has the broadest domain of the three organizational forms and can be characterized as the generalist within the population. Organizations A and C have narrower domains and, therefore, are the specialists within the population. Because of the relatively greater width of its domain, Organization B has a positive fitness over a broader range of environmental conditions than do Organizations A or C. In contrast, Organizations A and C are more fit within their domains than

[2]The concepts of niche width and overlap are typically used by ecologists at the interspecies level. Here we refer to the width and overlap between phenotypes (organizational forms) within the population.

Figure 2-2



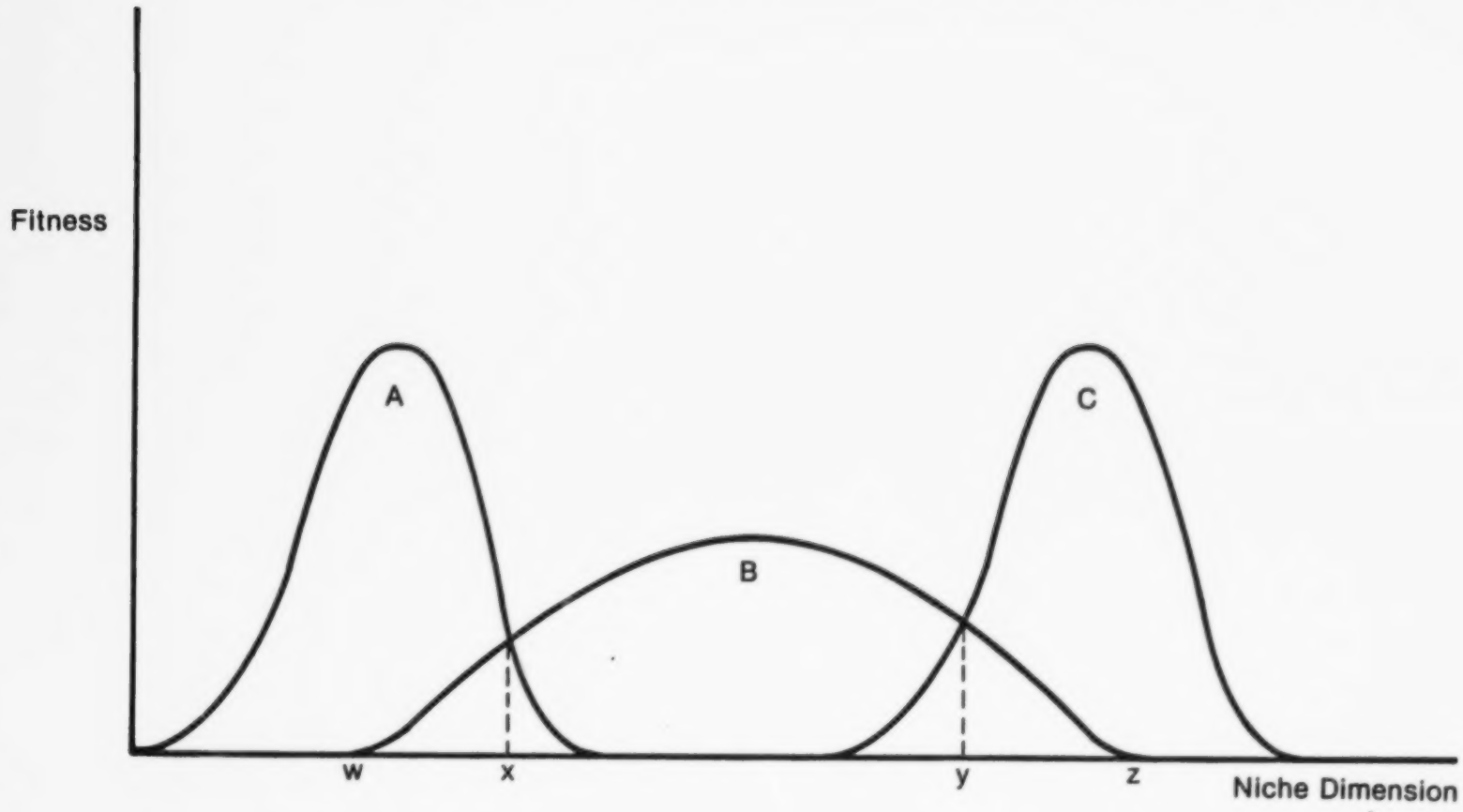
Niche Dimension

A. Wide Niche Breadth—Population of Generalists

Niche Dimension

B. Narrow Niche Breadth—Population of Specialists

Figure 2-3
Fitness Functions for Three Organizations in a Population



Organization B is within its domain as is indicated by the relative heights of their respective fitness curves.

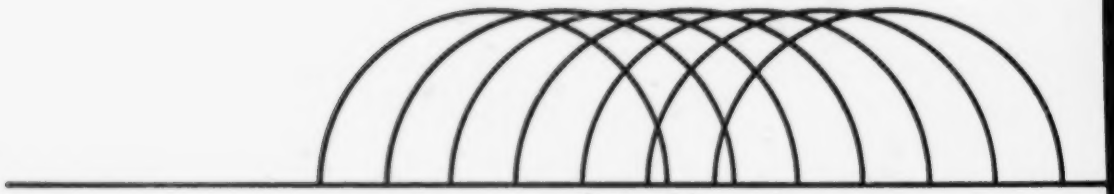
The rationale for the differences in height of the fitness curves among the generalist and specialist organizational forms is that specialization enhances efficiency. The concentration of activities within a specialized domain allows for economies of scale, reduces the need for excess capacity to buffer the organization from the effects of changes in demand, and reduces the amount of resources that need to be devoted to the coordination of an organization's activities (Zammuto and Cameron, 1985). As a result, specialist organizations will outcompete generalist organizations in the parts of the niche in which they have specialized when environmental conditions are stable because of their greater efficiency. In terms of Figure 2-3, this means that A will outcompete B between points w and x on the niche dimension, and C will outcompete B between points y and z. At a later point, the relative benefits of generalism versus specialism in changing environments will be examined.

The term niche overlap refers to the extent that organizations within a population select similar domains of operation. In Figure 2-4A, the population would be characterized as having a low degree of niche overlap since each organization within it has a distinct domain. Low niche overlap is characteristic of industries where there is a high degree of market segmentation in terms of products, customers, or geographic regions served. In essence, the less similarity of domains of organizations within a population, the less direct competition there is among them.

Figure 2-4

Niche Dimension

A. Population with Low Niche Overlap



Niche Dimension

B. Population with High Niche Overlap

In contrast, Figure 2-4B can be characterized as representing a population with a high degree of niche overlap, which is characteristic of industries with commodity-like products. Generally, a high degree of niche overlap indicates that there is little specialization or market segmentation in a population with respect to products, customers, or geographic regions served. Direct competition among organizations within a population is likely to increase with the extent to which their domains overlap.

Considering these dimensions in combination, it's easy to see that there are potentially many different ways in which organizations within a population can be organized. For example, a population may consist of a few generalist organizations that have a relatively high degree of overlap among themselves. This was characteristic of the structure of the American automotive industry during the late 1960s, where the major three firms, GM, Ford, and Chrysler, produced full lines of models, and competed with each other in each market segment. In contrast, an industry may be composed of many specialist organizations with a low degree of niche overlap, such as local offices of various social service agencies. Or, a population can be composed of a variety of generalists and specialists with varying degrees of overlap throughout the niche. The population of colleges and universities provides an example of this in that the geographic market for educational services is segmented but has varying levels, from local to national (Zemsky and Oedel, 1983). And, differences in the programs offered by colleges and universities result in a wide variety of specialist organizations as well as a significant number of generalist educational institutions. In short, populations of organizations can have a wide variety of

internal structures. Differences in these structures can affect how populations and the organizations within them adapt to changing environmental conditions, something that will be considered in greater detail later.

Population Density and Organizational Strategy

Population density is the extent to which a population fills its niche. The concept of population density is important to the study of adaptation for two reasons. First, the process by which a population proliferates within its niche is density-dependent, meaning that the rate of population growth depends on the extent to which the niche is already filled. Second, the success of various organizational strategies for exploiting a niche depends on the extent to which the niche is filled.

At zero density a niche can be said to be empty, waiting for a population to evolve and fill it. For example, Boulding (1978: 116) noted that

> There is an empty niche, for instance, in the ecosystem of human artifacts for a battery that would store large quantities of electricity cheaply. There have been enormous payoffs for this for nearly one hundred years yet it has not been invented. Even in the biosphere there is now clearly an empty niche for anything that will eat nylon, a substance that was unknown until the human race started to make it. A mutation in a bacterium, for instance, which will enable it to eat nylon would have been quite worthless before the development of the chemical industry, thus it is not surprising that there is no organism that eats it. Now, however, such a mutation would immediately create a species to occupy an empty niche.

At the other end of the spectrum, a niche can be completely filled when a population has reached its niche's carrying capacity. This is characteristic of mature industries, where the existing population completely satisfies the demand for goods and services.

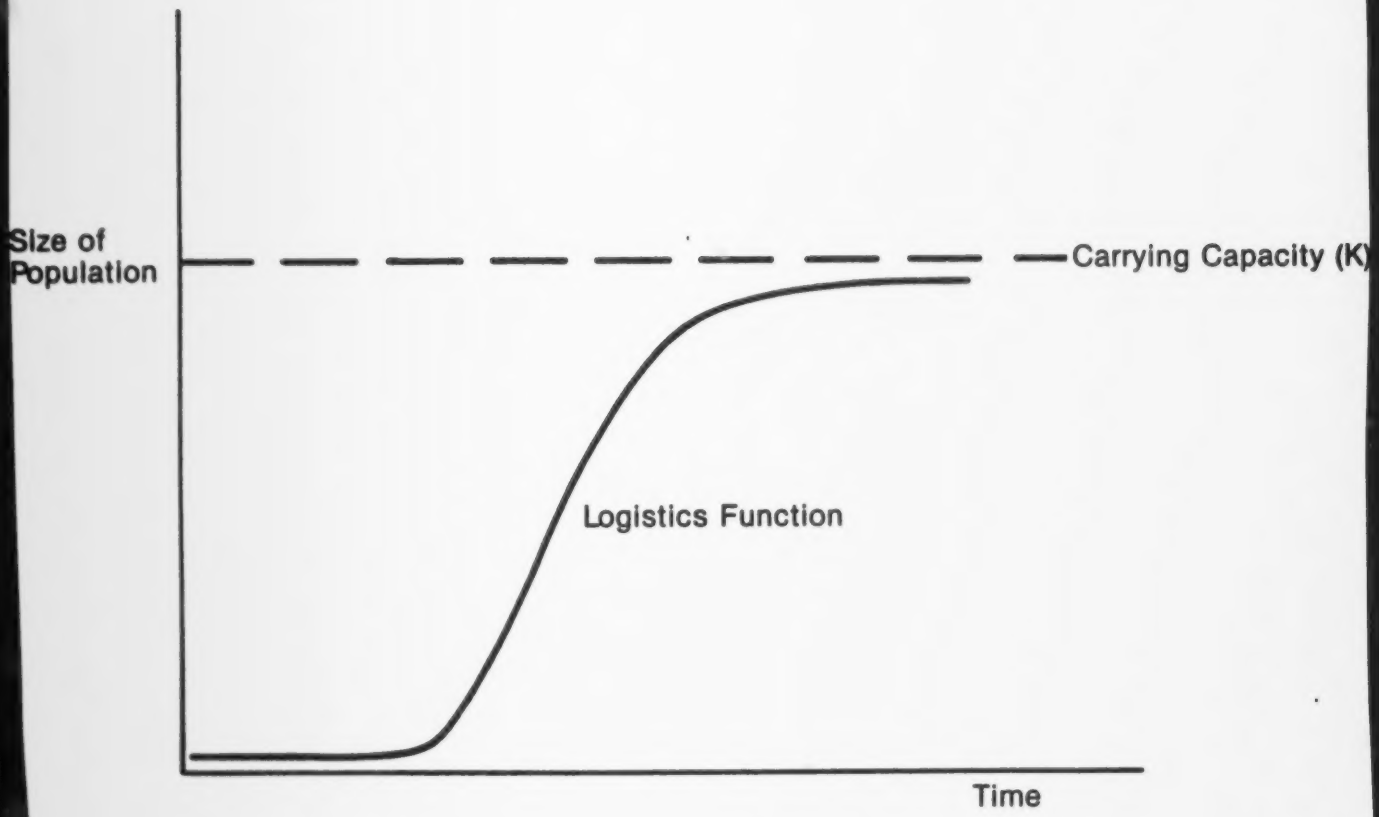
Ecologists have studied the proliferation of organisms within niches with logistics functions that generate S-shaped population growth curves as shown in Figure 2-5. A common logistics function used in ecology is the Pearlman-Verhulst logistics equation,

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right).$$

In the equation K represents the carrying capacity of the niche, r is some intrinsic rate of increase (the reproductive rate) of the population, N is the number of organisms in the population, and t is a unit of time. Generally, an empty niche will attract occupants at an initially slow but then exponential rate. As the population's density increases, entry into the niche becomes less attractive and the population growth rate slows. Eventually population growth stops when the carrying capacity of the niche is reached.

Eighmy and Jacobsen (1980) described three patterns of niche occupation based on the logistics function in a study of the proliferation of Hutterite and Mennonite communities in Europe and North America. The three patterns--formative, S-shaped, and mature--represent portions of the population growth curve based on differences in the initial density of a population and the length of time studied. For example, the formative pattern represents the lower half of the population growth curve in Figure 2-5, and occurs when a population inhabiting a niche begins at a low initial population

Figure 2-5
The Logistics Model of Population Growth



density that increases at an accelerating rate. An example of this pattern was the establishment of Hutterite communities in North America. Eighmy and Jacobsen (1980) noted that Hutterite farmers settled a small number of communities (n=3) in North America one hundred years ago, and the number of communities exhibited an accelerating rate of growth over time, representing the takeoff portion of the logistics curve.

Given a long enough period of time, Eighmy and Jacobsen (1980) suggest that the formative pattern will eventually result in the full S-shaped population growth pattern depicted in Figure 2-5. Their data show that the settlement of towns in the Deerfield, Massachusetts area during the 18th and 19th centuries and the establishment of Morovian Hutterite communities in Europe during the 16th century fit the S-shaped pattern of population growth. Finally, the mature pattern occurs when initial population densities are large. There is no gradual takeoff period leading to an accelerating rate of growth. Rather, the initial rate of growth is exponential and then decreases as the carrying capacity of the niche is reached.

An example of the mature pattern is provided by the establishment of Mennonite communities in Mexico during the 20th century. These communities were established by Mennonite farmers migrating from Canada. Between 1922 and 1926 they settled 25 villages. The number of villages increased rapidly over the next 20 years, but then rapidly tapered off as the land available for farming declined. The growth pattern, therefore, approximated the latter half of the logistics curve. Overall, data for several samples exhibited a high degree of fit with the logistics model of population growth (median goodness of

fit, r^2=.97), indicating that the logistics function provides a useful way of modeling proliferation in organizational as well as biological populations.

The type of strategy that does well in a population also is density-dependent to a degree. In the formative period, organisms that reproduce quickly have a competitive advantage. Since there is little competition among organisms in a low density population, rapid production of offspring is a viable strategy for perpetuation of the species. But as the density of the population increases, competition among organisms within the niche also increases, which reduces the viability of immature organisms. As a result, putting more energy into competing for resources within the niche and less into reproduction tends to be the best competitive strategy in the mature stage of population growth. MacArthur and Wilson (1967) labelled these two opposing patterns as r-selection (reproduction) and K-selection (competition), after the two terms in the logistics equation.

Brittain and Freeman (1980) noted that this distinction between types of selection pressures can usefully be applied to the general manner in which organizations within a population attempt to exploit the population niche and gain competitive advantage. They suggested two opposing types of organizational strategies, r-strategies and K-strategies. Pure r-strategists are organizations that move quickly to exploit a niche as it opens up. They expand quickly into new areas of operation, and their success depends largely on what Brittain and Freeman (1980) label as "first mover" advantages, which include setting industry standards associated with the introduction of new products, significant cost advantages because of acquired experience over

organizations that enter the field later, and high profits that are often associated with being first on the market. This type of organization tends to persist only where population density is low, the pattern of resource availability is highly uncertain, and where resources are dispersed over time and space (Pianka, 1970).

In contrast, pure K-strategists are successful in densely populated niches. K-strategists focus in gaining competitive advantage through efficiency of operations as opposed to first mover benefits associated with the rapid exploitation of a newly opened niche. As Brittain and Freeman (1980) noted, K-strategists will outcompete r-strategists as the population's density approaches the limit set by the niche's carrying capacity because they utilize resources more efficiently than do r-strategists. Conversely, r-strategists will outcompete K-strategists in the formative stage of the proliferation process because they can more rapidly exploit opportunities within an opening niche.

Combining the discussion of r- and K-strategists with the earlier examination of the generalist and specialist organizational forms yields four distinct types of organizational strategies: r-specialists, r-generalists, K-specialists, and K-generalists. The r-specialist organizational form pursues a strategy of exploiting new opportunities in relatively unpopulated niches within a narrow domain of activity. The r-generalist strategy is similar in that this form moves quickly to exploit new opportunities, but over a broad range of activities. In contrast, the K-generalist's strategy is to engage in a wide scope of activities but rely on efficiency as the preferred mode of competition rather than the rapid exploitation of new opportunities. The

K-specialist's strategy is to operate within a narrow domain very efficiently.

The expectation, given ecological theory, is that the r-specialist and r-generalist forms will do well in situations where there are new opportunities to be exploited, such as when changes in niche shape make new forms of performance possible, or when an altogether new niche emerges. In contrast, the K-specialist and K-generalist forms are more likely to be successful as population density increases over time. Therefore, the r-strategists are more likely to be prevalent and perform successfully in the formative stage of the population growth process, while the K-strategists will become more prevalent and successful during the mature phase.

Although these population-level characterizations of organizational form and strategy appear rather abstract, they have direct analogues at the organizational level of analysis. For example, Miles and Snow (1978) developed a typology of strategic types in their study of organizational adaptation. Three of the organizational types--the defender, prospector, and analyzer--map directly onto the population-level typology of organizational strategy and form discussed above.[3] The addition of one additional strategic type--the entrepreneurial Type I organization suggested by Fouraker and Stopford (1968)--completes the match between classifications at the population and organizational levels of analysis. Table 2-1 displays the overlay

[3]The fourth organizational type discussed by Miles and Snow (1978), the reactor, has no analogue at the population level of analysis. This is largely due to the fact that the reactor form is not internally coherent as are the other three strategic types. Rather, Miles and Snow used it as a residual category to classify organizations not fitting into the other three organizational classifications.

Table 2-1

STRATEGIC TYPES AT THE ORGANIZATION AND POPULATION LEVELS OF ANALYSIS

Breadth of Domain	Basis of Competition: Efficiency	Basis of Competition: First-to-Market
Narrow	Org: Defender Pop: K-specialist	Org: Entrepreneur Pop: r-specialist
Wide	Org: Analyzer Pop: K-generalist	Org: Prospector Pop: r-generalist

of population and organization-level terms, and the match between types is discussed in the following sections.

Defender/K-specialist. The K-specialist form competes on the basis of efficiency within a relatively narrow domain of operation. Compare this to Miles and Snow's (1978: 37) description of the defender-type of organization:

> The most notable feature of the Defender's product-market domain is its narrowness and stability. Defenders typically direct their products or services only to a limited segment of the total potential market... A Defender's success in the industry hinges on its ability to maintain aggressively its prominence with the chosen market segment. This aggressiveness is most evident in the Defender's continuous and intensive efforts to become more efficient technologically. With stable products and markets, management can direct its attention toward reducing manufacturing and distribution costs while simultaneously maintaining or improving product quality. The result is seen in the Defender's ability always to be competitive on either a price or quality basis.

Clearly the defender is the K-specialist form of organization, matching the population-level description in both the relative narrowness of domain and competition within the niche on the basis of efficiency.

Prospector/r-generalist. The r-generalist form of organization competes by moving rapidly to exploit new opportunities within a niche over a relatively broad domain. Miles and Snow (1978: 55-6) describe the prospector in the following manner:

> ...the Prospector's prime capability is that of finding and exploiting new product and market opportunities. One of the purest expressions of the Prospector strategy came from the president of one of the companies in Miles and Snow's sample when he said, "We are a first to market company..." The Prospector's domain is usually broad and in a continuous state of development... The systematic

> addition of new products or markets, frequently combined with retrenchment in other parts of the domain, gives the Prospector's products and markets an aura of fluidity uncharacteristic of the Defender.

As can be seen in the above passage, Miles and Snow's description of the prospector-type organization touches on both of the major characteristics of the r-specialist organizational form, breadth of domain and quick movement to exploit opportunities.

Analyzer/K-generalist. The K-generalist form pursues a relatively broad domain of activity within the population niche, but unlike the r-generalist, it focuses on competing with other organizations on the basis of efficiency as opposed to the exploitation of new opportunities. Miles and Snow (1978: 72-4) describe the Analyzer as follows:

> The Analyzer's domain...is a mixture of products and markets, some of which are stable, others changing... The ideal Analyzer is always poised, ready to move quickly toward a new product or market that has recently gained a degree of acceptance... Whereas the Prospector is a creator of change in the industry, the Analyzer is a avid follower of change... Much of the Analyzer's growth occurs through market penetration since the organization's basic strength comes from its traditional product-market base... and the Analyzer's technological system is characterized by a moderate degree of technical efficiency.

The description of the analyzer-type organization contains the two basic elements of the K-generalist organizational form, a relatively broad domain and competition on the basis of efficiency. Miles and Snow's characterization of this form having a moderate degree of technical efficiency as compared to the Defender is consistent with the earlier discussion of the relative costs of generalism as opposed to

specialism. Moreover, Miles and Snow's description details the process by which K-generalist organizations expand their domains, through imitation of r-strategist organizations. The K-generalist or analyzer does not rely on being the first to exploit an opportunity within the niche. Rather, once an opportunity is established by the r-strategists within the population, the K-generalist will move into that part of the niche and rely on market penetration and efficiencies in production to compete with the r-generalists and r-specialists that have opened up that part of the niche.

Entrepreneur/r-specialist. The r-specialist moves quickly to exploit environmental opportunities within a relatively narrow domain of activity. As was noted earlier, Miles and Snow did not include this type of organizational form in their typology. But they did examine Fouraker and Stopford's (1968) analysis of the evolution of organizational structure. The first form discussed by Fouraker and Stopford (1968) was the Type I organization, which Miles and Snow (1978: 118) described as typically being

> owner-managed, limited to a single product line, and characterized by a structure in which all major decisions flowed directly from the entrepreneur-administrator. The chief executive attempted to monitor all activities, and his staff served merely as an extension of his will. Such organizations could move quickly and forcefully into limited areas, constrained only by their adeptness and the energy of their unitary director.

This description contains both of the components that defined the r-specialist organizational form, narrow domain and quick movement to exploit new opportunities. In effect, the r-specialist is the quintessential "start-up" organization.

Miles and Snow (1978) may have excluded the entrepreneurial organizational form from their typology largely because of its relative instability over time. Entrepreneurial or "start-up" organizations are prone to failure. As Stinchcombe (1965) argued, and Freeman, Carroll and Hannan (1983) demonstrated, there is a "liability of newness." New organizations have higher mortality rates than those that have survived their first few years.

There are a number of possible reasons for the higher rate of failure for entrepreneurial organizations. For example, they will will fail if niche they have attempted to exploit or create is not viable. If the niche turns out to be viable, the entrepreneurial organization usually has to compete with later entrants into it. In this situation, the entrepreneurial organization becomes vulnerable to the greater efficiencies of analyzer and defender organizations. Moreover, entrepreneurial organizations that open up new niches or are created in expanding portions of old niches become vulnerable to acquisition, particularly by analyzer organizations that are looking for rapid entry into a new domain of operation.

If the entrepreneurial organization grows and prospers during its first few years, it also is likely to transform itself into one of the other three organizational forms discussed earlier. For example, if it concentrates on establishing or maintaining dominance in its original area of operation through economies of scale or product quality, it is likely to become a defender. Or if it uses its resources to move into additional domains of operation, it can transform itself into a prospector. Finally, if it first establishes itself as a defender then moves into other areas of operation, it may become an analyzer.

The entrepreneurial organization is likely to maintain its form only if resources are dispersed in time and space. Typically, this means that markets within the entrepreneur's industry are highly localized, as in the restaurant industry. Even in markets that historically have been localized, the entrepreneurial organizational form has been threatened by the establishment of franchising operations and the entry of corporate chains into areas such as the restaurant, grocery, and hardware businesses.

Given the relative instability of the entrepreneurial form, it is not surprising that Miles and Snow (1978) did not include it in their typology. Three of the industries--publishing, hospital, and food processing--are relatively mature, and it is unlikely that many entrepreneurial organizations existed in them. In their fourth industry sample, semiconductor firms, they may not have included any or many entrepreneurial organizations in their sample.

It is important to note that while these forms of organizations are found at both the population and organization levels of analysis, they are used in different but complementary ways. At the population level of analysis the emphasis is on selection pressures that differentially favor the organizational forms over time. For example, environmental selection in a densely populated environment will, over a period of time, favor K-type organizations over r-type organizations. In contrast, at the organization level of analysis the emphasis is on the domain strategy an organization will choose to exploit the environment. Taken together, the approaches indicate that organizations chose domain strategies (i.e., select how they will

exploit the population niche) but that the relative success of different domain strategies over time is density-dependent.

Over a period of time in a stable niche, defenders and analyzers will eventually replace entrepreneurs and prospectors as the density of the population approaches the niche's carrying capacity. At any given time, it is possible for a mixture of organizational forms to exist within the population, but the degree to which one form is more prevalent than the other is density-dependent. In the formative stage of organizational proliferation, entrepreneur and prospector organizations should be more common than defender or analyzer organizations. Conversely, in the mature stage of the growth process, defender and analyzer organizations should be more common than entrepreneur and prospector organizations. A homogeneous population would be expected only at the inception of the formative stage and the end of the mature stage, when a population is most likely to be composed of all r or all K-type organizations respectively.

This line of argument explains Miles and Snow's (1978) and Snow and Hrebiniak's (1980) findings of mixed populations in the industries they studied in their examinations of strategic type using the Miles and Snow typology. But it is also the opposite of the conclusion they drew from their studies. Both Miles and Snow (1978) and Snow and Hrebiniak (1980) argued that their findings disproved the organizational ecology perspective because the environment did not determine organizational parameters. However, the claim is not well-founded because the studies did not incorporate time as a relevant dimension. Both studies were cross-sectional, but the effects of

environmental selection pressures can be observed only through longitudinal studies.

Finally, the notions of density-dependence and the existence of different organizational forms in a population set the stage for a discussion of the dynamics of competition. Competition is the most important type of interaction that occurs among members of an organizational population.[4] It is the process through which different organizational forms gain dominance as the density of the population changes. The following section examines the dynamics of competition.

Competition

Competition occurs among organizations within a population when they use the same resources, and when those resources are in short supply (Pianka, 1983). As was noted earlier, the study of competition by Gause, Lotka, and Volterra in the 1920s and 1930s did much to popularize the niche concept in biology during the mid-20th century. Their work still forms the foundation on which most of the current research on competition in ecology is based.

One of the most significant outcomes of this work was the competitive exclusion principle, which states that "complete competitors cannot coexist (Hardin, 1960: 1292)." Roughly, this means that if two populations occupy exactly the same niche in a saturated environment, the population that marginally reproduces faster will

[4]Other forms of population interactions studied by ecologists in biology include predation, parasitism, and mutualism (Pianka, 1983). Some of these other forms may be useful in discussing interactions between organizational populations, but the following discussion is limited to within-population dynamics.

displace the other population, which will become extinct.[5] Research in ecology has subsequently shown that "for any particular pair of closely related species there exist subtle ecological differences of one sort or another, even though it did not appear initially that the two were ecologically distinct" (Vandemeer, 1972: 108). As Hardin (1960: 1296) noted, the competitive exclusion principle can be restated as: "Ecological differentiation is the necessary condition for coexistence."

At the level of competition within a population, this implies that the domains of two organizations in a saturated environment cannot completely overlap. For example, two liberal arts colleges in the same area may offer identical academic programs but coexist because they recruit from somewhat different student populations. However, the degree of direct competition between organizations within a population increases the more their domains overlap. And, as Hannan and Freeman (1977: 943) noted, "the broad conclusion is that the greater the similarity of two resource-limited competitors, the less feasible it is that a single environment can support both of them in equilibrium."

More formally, competition has been modeled using a derivation of the logistics growth model, commonly known as the Lotka-Volterra equations for competing populations (Pianka, 1983). For two competing populations, the Lotka-Volterra equations are:

[5]The principle should be taken as suggestive rather than as a hard-and-fast rule. A number of ecologists, such as Pianka (1983) and Hutchinson (1957), have shown that there are many situations in which the principle does not hold. However, as Hannan and Freeman (1977) have argued, most of the criticisms do not apply to the type of qualitative inferences drawn here.

$$\frac{dx_1}{dt} = r_1 N_1 \left(\frac{K_1 - N_1 - \alpha_{12} N_2}{K_1} \right)$$

$$\frac{dx_2}{dt} = r_2 N_2 \left(\frac{K_2 - N_2 - \alpha_{21} N_1}{K_2} \right)$$

As was the case for the logistics growth model, K and r are the carrying capacity and the intrinsic rate of increase for each population. N represents the size of each population, and $\alpha 12$ and $\alpha 21$ are competition coefficients, denoting the magnitude of effect that increases in one population will have on the other. Competition coefficients can assume values from 0 (i.e., no competition) to 1 (total competition), which results in the dynamics described by the principle of competitive exclusion. As Hannan and Freeman (1977: 942) noted, the consequence of competition in this two-population formulation is to "lower the carrying capacity of the environment for a population of organizations, the degree of which is a function of the magnitude of the coefficients."

The Lotka-Volterra equations can be extended to include M competitors (Levins, 1968):

$$\frac{dN_i}{dt} = r_i N_i \, (K_i - N_i - \Sigma \, \alpha_{ij} N_j)/K_i \quad (i \neq, \ldots M),$$

with a community equilibrium when

$$K_i = N_i + \Sigma \, \alpha_{ij} N_i .$$

These equations can be expressed as a single matrix:

$$K = AN$$

where N and K are (M X 1) column vectors and A is the community matrix:

$$A = \begin{pmatrix} 1 & \alpha_{12} & \cdots & \alpha_{1M} \\ \alpha_{21} & 1 & & \\ \vdots & & & \\ \alpha_{M1} & \cdots & \cdots & 1 \end{pmatrix}$$

whose elements are the competition coefficients.

McPherson (1983) provides an interesting application of the Lotka-Volterra equations in a study of competition among voluntary organizations for members. Included in his sample were twelve types of voluntary organizations, such as church board, professional, civic, sports, union, youth-serving, and elderly organizations. McPherson calculated a measure of niche breadth for each of four dimensions that reflected the composition of membership for each organizational type. These dimensions were age, socioeconomic status, proportion female members, and years of education. Niche breadth for each dimension was then calculated by determining a range 1.5 standard deviations from the mean for niche dimensions for each organizational type. As would be expected some organizational types were more generalized than others in terms of their membership. For example, McPherson (1983: 525) noted that

> The two types with the narrowest age breadths are youth-serving and elderly organizations, both with a niche breadth of twelve years of age. The broadest age breadth is for civic organizations, with a breadth of 28 years. The broadest niche in occupational status is for hobby groups, with a breadth of 35 socioeconomic index (SEI) points. The narrowest niche breadth on education is for professional associations; the broadest is for organizations for the elderly.

McPherson then used a calculation suggested by Hutchinson (1957) to define the area in niche space from which the different types of organizations recruited members. Assuming independence, the niche breadths of any two dimensions could be used to define a rectangular area in two-dimensional niche space, the product of which indicated the size of the niche space (niche base) from which an organizational type recruited. If two organizational types are plotted together, the area of intersection between the rectangular representations of their niche bases defines the extent to which their niches overlap. By virtue of the rectangular shape of the niche bases, the intersections between them are also rectangular, making calculation of niche overlap straightforward. By extending this scheme to multiple dimensions, it becomes possible to calculate the size of the niche space for each organizational type, and the degree of overlap among the different organizational types over the four niche dimensions. The greater the degree of overlap, the greater the extent to which the different organizational types recruited from the same pool of potential members. McPherson found varying degrees of overlap among the organization types. For example, almost all groups competed heavily with the church board and hobby groups since these groups had very large niche bases. In contrast, organizations for the elderly had no overlap with any other type of organization because of the restricted age range of their membership.

McPherson calculated competition coefficients as the ratio of the volume of the overlap between two types of organizations and the volume of the niche base for the type of organization being examined. He described the results as follows:

> The absence of overlap for elderly organizations...produces zero coefficients of competition for this organizational type... Almost all types compete heavily with hobby and church board organizations... This result occurs because these groups occupy very large niche bases and have substantial overlaps with more specialized organizations. For instance, youth-serving organizations are almost entirely inside the volume occupied by church board... Thus 98 percent of memberships in youth-serving organizations come from the same social space as church board memberships.
>
> On the other hand, only about 34 percent of the church board memberships come from the social space occupied by youth-serving organizations. Church boards are far more general organizations; they have a much larger volume. Since most youth-serving memberships came from the church board domain, each such youth membership reduces the available pool for church boards by nearly one. Conversely, since most church board memberships come from outside youth's domain, each church board membership does not, on the average reduce the available pool for youth-serving organizations as much (McPherson, 1983: 526).

As can be seen in McPherson's findings, competition between generalists and specialists is assymetric. The specialist competes more heavily with the generalist than vice versa. Moreover, as McPherson (1983: 526) noted, "specialists don't compete intensely with one another, since they occupy small regions in social space where they presumably are well adapted to monopolize resources."

On the other hand, competition between generalist organizations is likely to be fairly intense since they overlap along a broad range of a given niche dimension. Therefore, the structure of competition as perceived from inside generalist and specialist organizations will be different. For example, Zammuto (1984b) provides data on perceived competition for students among colleges and universities. He found that specialized liberal arts colleges listed other specialized liberal

arts colleges and generalist comprehensive institutions, which offered both liberal arts and professional programs, as their primary competitors for student enrollments. Specialized professional institutions cited other specialized professional institutions and generalist comprehensive institutions as their competitors. In contrast, comprehensive institutions usually cited only other comprehensive institutions as competitors, and rarely mentioned the other two types of specialized institutions.

McPherson (1983) also noted that the overall characteristics of the community matrix contain useful information about the structure of a population. For example, the overall mean of the competition coefficients indicates how closely packed organizational types are within the niche space. High means indicate that organizational types are similar in composition. Similarly, the variance of the coefficients indicates the degree to which organizations are clustered within the niche. High variability suggests that organizations within a population are clustered into sectors, with high intrasector competition and little interaction across sectors. A low standard deviation would indicate more even dispersion throughout the niche space.

Finally, Hannan and Freeman (1977: 944) noted that the postulated competition processes have a number of implications for organizational diversity. "In particular one can show that when growth in a population is constrained only by resource availability, the number of distinct resources niche dimensions along which organizations are differentiated sets an upper bound on diversity in the system. Even more generally, the upper bound on diversity is equal to the number of

resources plus the number of additional constraints on growth." In particular, this implies that "if one can identify environmental changes which add constraints to a system or eliminate them, one can conclude that the upper bound of diversity is increased or decreased." The importance of this observation, as will be shown in the next chapter, is that changes in the configuration of a niche will affect the diversity of organizational forms as well as the level of competition among organizations within the population.

Summary

The concept of an ecological niche provides a useful tool for modelling the environments of organizations. An ecological niche is an n-dimensional volume in time and space defined by a set of physical, biological, and social conditions that provide resources for or place constraints on the performance of an organizational population. Being a volume in time and space, ecological niches have both size and shape. The size of a niche is its carrying capacity, defined as the level of population performance that the niche will support. The shape of a niche defines the boundaries of performance; that is, the types of performance that are possible under existing environmental conditions and constraints.

Organizations within populations make choices as to what part of the niche they will inhabit. Their choices constitute their domain, the range of products produced, populations served, and services rendered. The distribution of organizations within niche space varies according to the breadth of the selected domains and the degree to which these domains overlap. Broad domains indicate a generalist strategy for exploiting resources and opportunities within the niche.

Narrow domains reflect a specialist orientation. Niche overlap is the extent to which organizational domains within the population are similar. Populations may consist of organizations with little overlap in domains (i.e., segmentation of environmental resources and opportunities) or, at the other extreme, they may consist of organizations with very similar domains.

The configuration of the population in terms of the breadth and overlap of organizational domains, and the extent to which the population fills the niche, affect the level of competition within the niche and determine the types of organizations that will be most successful. At low population densities, there will be little direct competition among organizations because of abundant resources and opportunities. Organizations that move quickly to exploit environmental opportunities and resources--the entrepreneurs and prospectors--will be more successful than organizational types that focus on efficient production--the defenders and analyzers.

As the level of a population's performance approaches the carrying capacity of its niche, direct competition increases. And, the greater the degree to which organizational domains overlap, the greater the intensity of this increased competition. In this situation, the greater efficiency of the defenders and analyzers will lead to a displacement of entrepreneur and prospector organizations as the prevalent forms of organization within the population. When the level of population performance nears or reaches the equilibrium level at the niche's carrying capacity, the dynamics described by the principle of competitive exclusion will come into play. For organizations with domains that overlap to a great extent, the most efficient producers

will displace less efficient organizations. The implication is that ecological differentiation in organizational domains is a necessary condition for coexistence in saturated environments. At the extreme, this means that over the long run defender organizations will become the prevalent form in saturated, stable environments.

Thus far, the discussion has focused on the importance of examining the interplay of population characteristics that define an ecological niche in order to understand population-level dynamics. In effect, environment conditions have been held constant while studying the impact of population characteristics on the success and failure of organizations within the population. This discussion has set the stage for an examination of how ecological niches change and the impact these changes have on the organizations inhabiting them. As will be seen in the following chapter, changes in the size and shape of ecological niches have many implications for the types of dynamics observed, and for the success or failure of individual organizations within these niches. The following chapter constructs a typology of environmental change that can be used to discuss these issues.

Chapter 3: Draft

ENVIRONMENTAL CHANGE AND EVOLVING NICHES

Organizational adaptation takes place within the larger context of societal evolution, which Boulding (1978: 18) characterized as

> an extension, enlargement, and acceleration of the pattern of biological development, operating through mutation and selection. Selection is ecological interaction constantly creating new niches and destroying old ones; mutation takes the form of invention, discovery, expansion of the noosphere knowledge and human artifacts and the human noogenetic structure. Niches open up, and sometimes are filled, sometimes not, depending on the capacity of the system for mutation; each successful mutation opens some niches and closes others.

The opening and closing of niches within a social system, and the resultant creation, adaptation, and failure of organizations is not a simple reactive process. As Boulding (1978: 132) also indicated, "the human race is not merely pushed by past events or present circumstances, but it is also pulled by its own images of the future into a future, which may not be the same--and in fact is not likely to be the same--as its images of it, but is which nevertheless powerfully affected by these images." Organizations are both creators of and reactors to environmental change. Some organizations may promote changes in the niches they reside, through invention or discovery; they may create change unintentionally, such as through actions that lead to government regulation. Or, they may simply have to respond to changes created by the actions of other organizations.

This chapter examines two dimensions of environmental change that are closely related to the issue of organizational adaptation.

Variations along these dimensions differentially affect the behavior of populations and that of the organizations within them. These two dimensions are changes in the configuration of a niche, and the continuity with which these changes in configuration occur. The general thrust of the argument made in this chapter is that, depending on the types of changes occurring in a population niche, different dynamics will be observed among organizations within a population. Moreover, the strategies selected by organizations within the population will vary according to their individual positions within the niche. Changes in niche configuration are examined in the next section, and the continuity of environmental change is examined after that. These two dimensions are then used to create a typology of environmental conditions within which differential population dynamics, in terms of organizational success and failure, and changes in competition within the niche, will be discussed.

CHANGES IN NICHE CONFIGURATION

There are two basic ways in which the configuration of a niche may change. The size or carrying capacity of a niche can change; it can increase or decrease. Similarly, the shape of a niche can change, which modifies the types of organizational performance that the niche will support. With respect to Figure 2-1, where a graphic depiction of a hypothetical two-dimensional niche was presented, the vertical axis represented the size of the niche while the two horizontal axes defined the shape of the niche. Changes in niche size are represented by changes in the volume of the niche along the vertical axis while changes in the base of the volume on the horizontal axes represent changes in niche shape. Changes in niche size and niche shape may

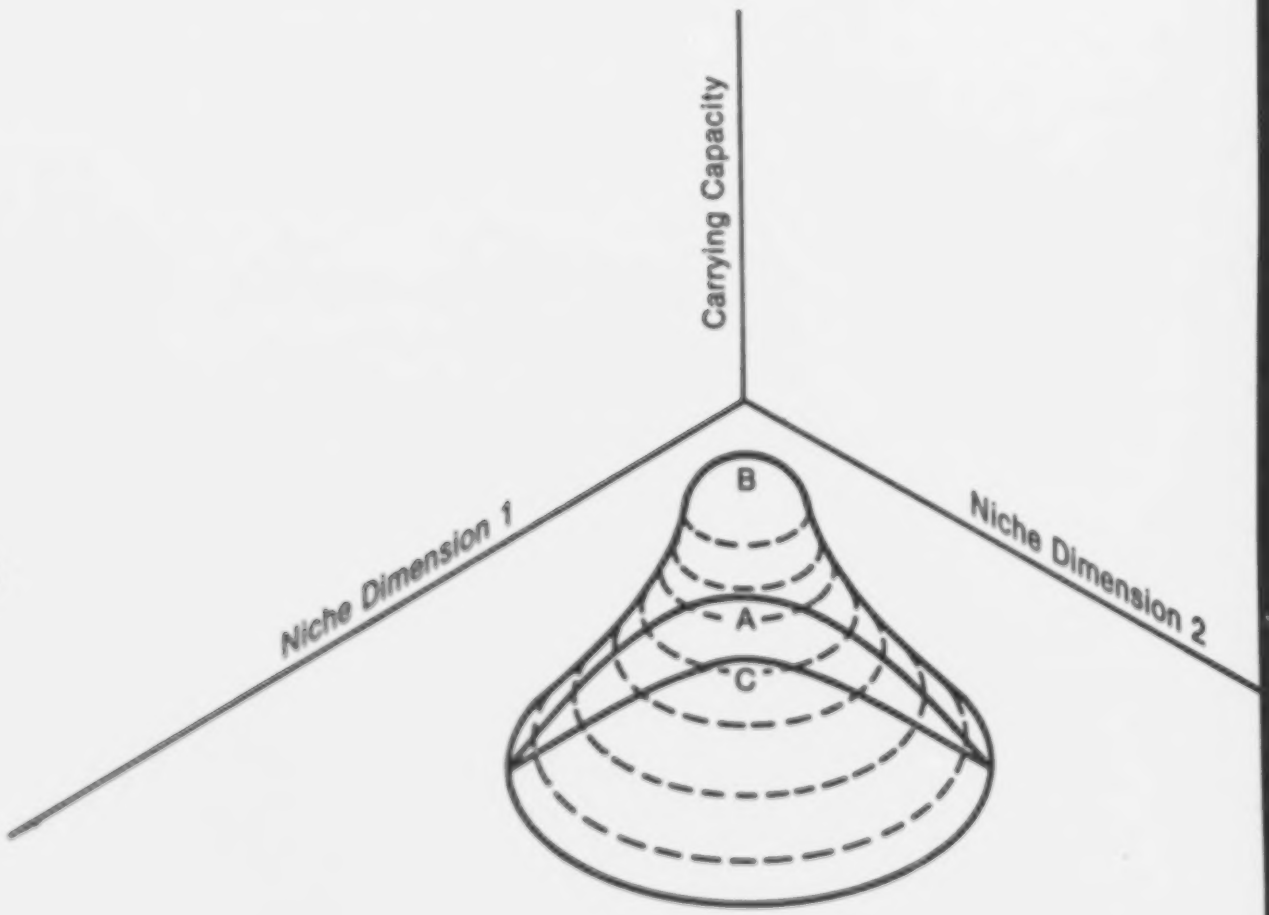
occur independently or jointly. To simplify the following discussion they will be treated independently.

Changes in Niche Size

The carrying capacity of a niche can change over time. Demand for products and services can increase or decrease, resources necessary for the production of those goods and services may become more or less available. Changes in the size of a niche are portrayed in Figure 3-1. The volume labelled A represents a niche at time t. Movement from Volume A to Volume B at time t+1 in Figure 3-1 represents an increase in the size of the niche, which means that the niche will support a greater level of the same types of activity at time t+1 as compared to time t. A number of changes in environmental conditions can lead to an increase in niche size. An expanding economy, an increasing number of potential customers or clients, increased utilization of a product or service by an existing consumer base, or favorable governmental policies can increase the size of a niche.

For example, the size of the college and university niche increased considerably during the 1950s and 1960s as a result of a number of factors. Returning veterans from World War II, Korea and Vietnam taking advantage of the GI bill as well as members of the baby boom reaching college age sharply increased enrollments. A federal policy of equal access to education and generous student aid programs also increased demand for college education. Overall, the number of students enrolled between 1946 and 1970 increased 380 percent, from 2.08 million to 7.92 million students (National Center for Education Statistics, 1981).

Figure 3-1
Changes in Niche Size

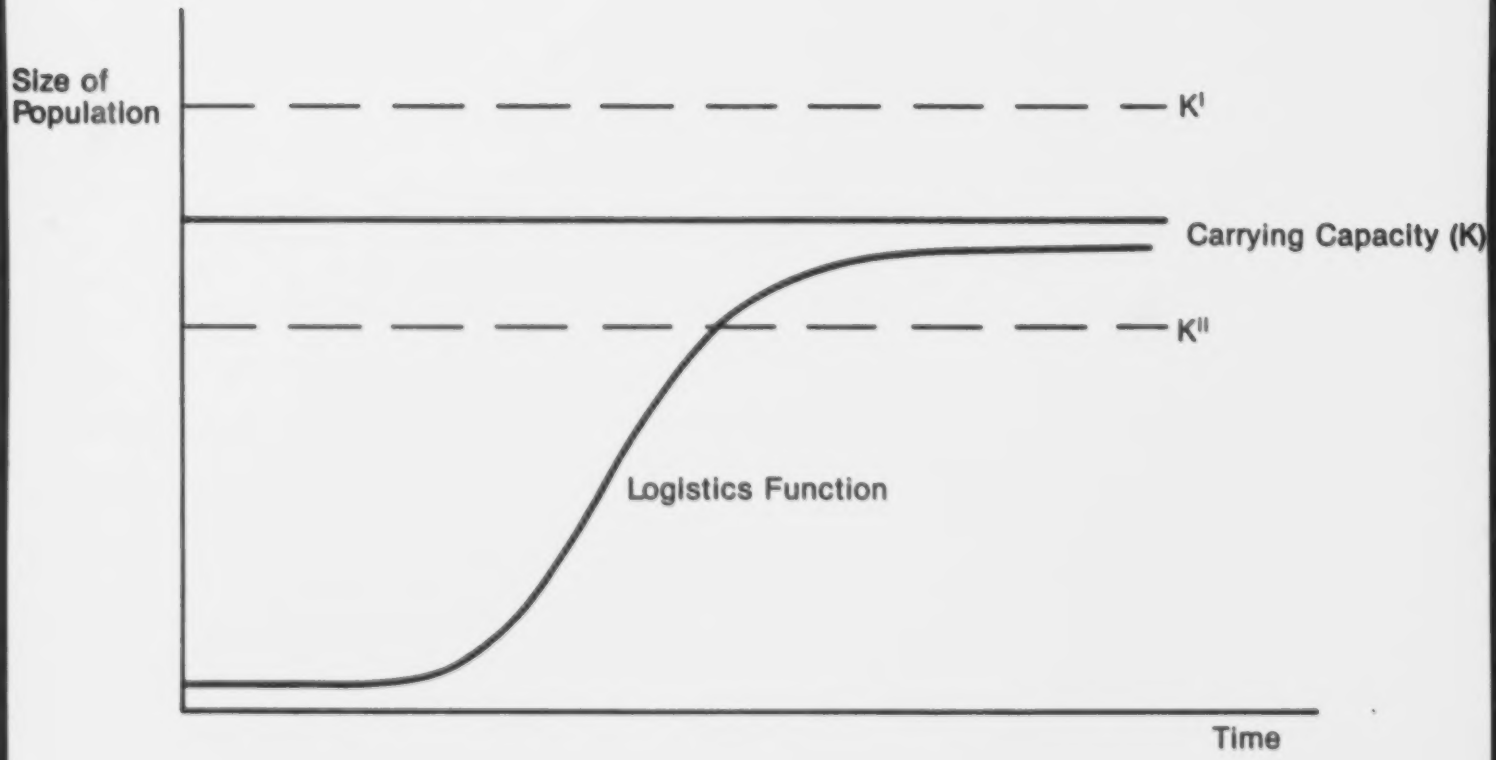


Conversely, economic recessions, resource scarcity, a declining potential consumer base, or decreased utilization of a product or service can result in a reduction of niche size. This situation is represented in Figure 3-1 by movement from Volume A to Volume C. For example, the size of the baby food industry's niche declined during the 1960s and early 1970s as the number of live births in the United States decreased. A high of 4.2 million births were recorded in 1957 and declined to 3.0 million births in 1976, when they began increasing. The effect was to reduce the level of demand for baby food products.

Changes in the size of a niche have a number of effects on the population inhabiting it that are related to population density. Figure 3-2 presents the S-shaped population growth curve shown earlier in Figure 2-5, with the two hatched lines representing changes in carrying capacity. An increase in niche size, depicted by movement of the carrying capacity line from K to K', has the effect of reducing the density of the population. Assuming that the population was near or at the niche's carrying capacity, an increase in niche size will reduce competition among organizations in the population. If the increase in size is of a considerable magnitude, or if it occurs relatively quickly, it will create opportunities for the entry of new organizations into the population. And, as a result, entrepreneurial or prospector forms of organization may reappear in a niche from which they exited earlier as the population entered the mature phase of growth in the original niche.

Conversely, decreased carrying capacity, represented by movement from K to K", will increase competition among organizations in a population. Competition will lead to the attrition of organizations in

Figure 3-2
Logistics Growth Model and Changes in Niche Size



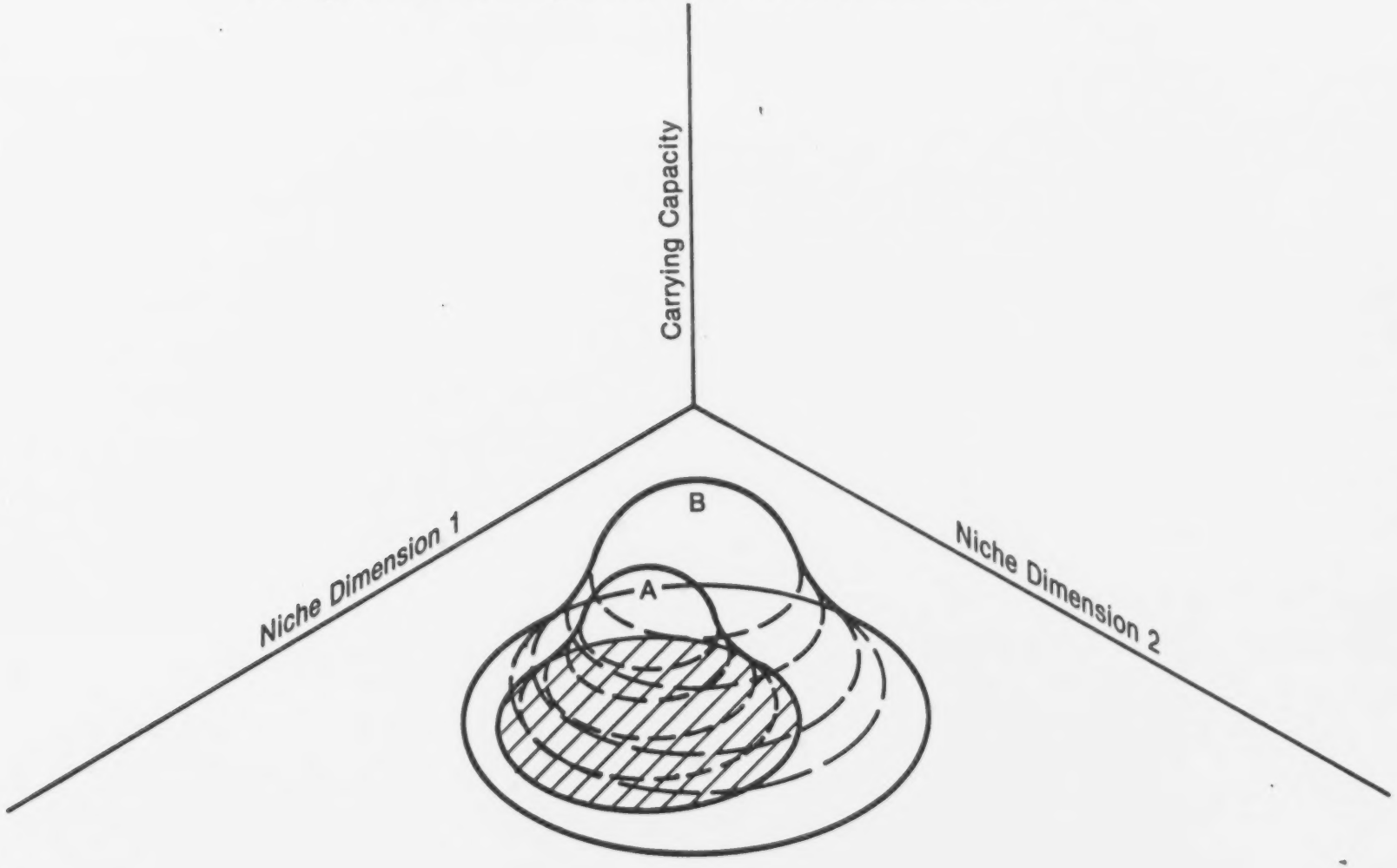
the population until the new equilibrium indicated by K" is reached. The greater magnitude or speed at which the decrease occurs, the greater the intensity in competition and, subsequently, increased organizational failures within the population. Defender and analyzer organizational forms, if they had not already eliminated prospector and entrepreneurial organizational forms through competition, are likely to do so in this type of situation.

The changes in niche size discussed above assume that the shape of the niche remained constant. When niche shape remains constant as niche size changes, the dynamics inferred from the logistics growth model apply. When the shape of a niche changes, a set of different but related dynamics are likely to be observed. Changes in niche shape and their affect on population dynamics are examined in the following section.

Changes in Niche Shape

Changes in niche shape occur as the dimensions defining a niche change or the values along those dimensions shift, either of which redefine the niche base portrayed in the two dimensional model in Figure 2-1. Figures 3-3 and 3-4 represent two common types of changes in niche shape. In Figure 3-3, the placement of the two volumes can be interpreted as the type of performance the niche will support as having expanded from time t to time t+1 to include more types of organizational performance. For example, the niche of the personal computer industry in 1976--when Apple introduced its first product--can be characterized as Volume A. By the early 1980s, the niche had expanded significantly in both size and carrying capacity. The range

Figure 3-3
Change in Niche Shape: Expansion of Potential Performances



of products and their uses expanded considerably as did overall demand for those products.

Our interest, for the moment, is primarily on the changes in niche shape and not changes in niche size. The change in the area of the niche bases of volumes A and B denotes that more forms of organizational performance are possible at time t+1 as compared to time t. In more traditional terms, this is characteristic of the munificent environment of an expanding industry. And in the above example of the personal computer industry, the niche evolved as technological advances made new forms of performance possible.

A variety of factors can account for changes in niche shape. Changing consumer preferences can result in the evolution of a niche's shape. For example, shifting student preferences for fields of study, from the liberal arts and sciences to the applied sciences and professions, coupled with advances in knowledge and the opening of new fields of study, have changed the shape of the college and university niche considerably over the past two decades. Similarly, government regulation can result in the creation and expansion of niches. For example, the proliferation of environmental legislation since the mid-1960s created and expanded the niches of industries that develop and manufacture pollution control equipment, dispose of toxic wastes, and so on.

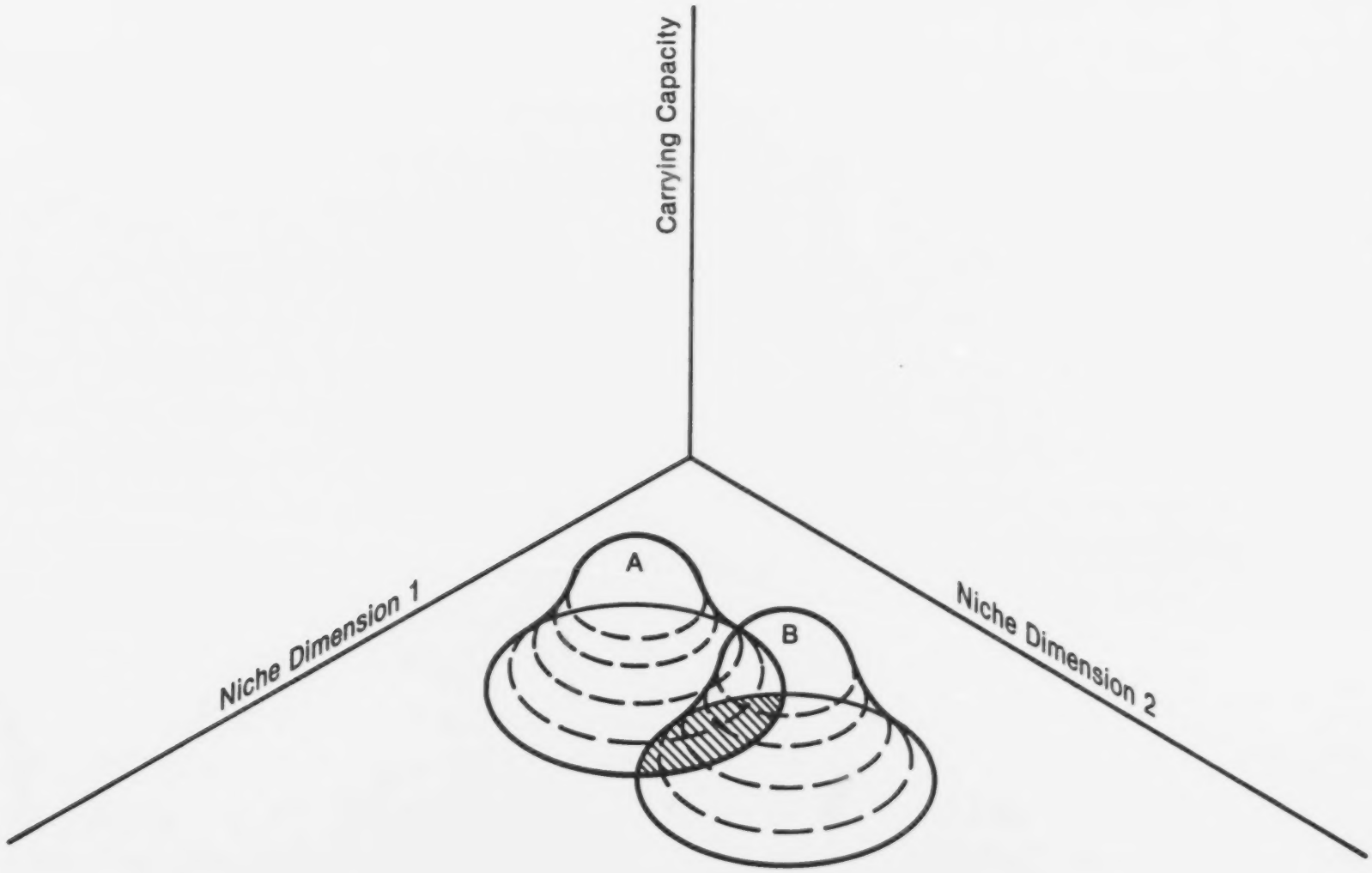
The effect of such expansionary changes in niche shape parallel those observed when a population initially begins proliferating in a newly opened niche. If new areas of performance open quickly, entrepreneurial and prospector organizations proliferate as they move to exploit new opportunities. The level of competition will be low

initially because of low population density, but gradually increase as the population begins to fill the niche. Moreover, the greater the expansion of the potential forms of performance possible in the evolving niche and the greater the difference between the potential and existing forms of possible performance, the more likely the proliferation of entrepreneurial and prospector organizations to exploit them.

In contrast, the more gradual niche expansion or the greater the extent that new forms of performance are simple extensions of old ones, the more likely that defender and analyzer organizations will expand into the newly opened areas. This doesn't suggest that entrepreneurial or prospector organizations will be precluded in this situation. Rather, it means that movement by defenders and analyzers into new areas of performance is more likely when new performance opportunities are similar to the existing domains of those organizations than when they are not. Such movement by defender and analyzer organizations reduces the magnitude of opportunities for entrepreneurial and prospector organizations. In short, the greater the rate or magnitude of niche expansion, the more likely that new performance opportunities will be exploited by r-strategists. Niche expansion that is gradual in rate or magnitude increases the likelihood that K-strategists also will move to exploit new performance opportunities.

The other side of the coin is changes in niche shape that reduce the range of performances in which a population has historically engaged. Figure 3-4 depicts this type of change in niche shape. Movement from Volume A to Volume B over time, results in most of the forms of performance possible in A no longer being possible as the

Figure 3-4
Change in Niche Shape: Shift of Potential Performances



57

niche evolves to configuration B. The overlapping area of the two niche bases indicates the types of performance possible in A that are included in B. In effect, this diagram shows a niche evolving over time; part of the niche closes as another part expands.

This type of change in niche shape has the effect of increasing population density in the shrinking area of Volume A, while creating new performance opportunities in the expanding area of Volume B. Two different sets of population dynamics are likely to occur. In the portion of the niche that is contracting, population density increases, resulting in intense competition. Organizations with domains in the disappearing portion of the niche (nonoverlapping portion of Volume A) either have to change their domains or fail. The most efficient defenders and analyzers will displace other organizations in the shrinking but still existent portion of the niche (overlapping areas of Volumes A and B). In contrast, entrepreneurial and prospector organizations will be the environmentally favored organizational forms in new areas of potential performance (nonoverlapping portion of Volume B) to the extent that the shift in niche shape is rapid or of a sizeable magnitude.

In extreme cases, the shift in niche shape will bifurcate the population into two segments; one of which is composed primarily of defenders and analyzers in a highly competitive situation, the other being dominated by entrepreneurial and prospector organizations with little competition. The division between the two segments of the population will disappear as the shape of the niche stabilizes, a shake-out takes place in the shrinking portion of the niche, and the

density of organizations in the expanding portion of the niche increases.

However, if the evolution of the shape of the niche is continuous, these dynamics will be sustained over time. Little competition will be evident on the leading edge of the expanding portion of the niche, while competition will increase in the region of the trailing edge of the niche. The likely effect is that the population will be in a continual state of transition. Entrepreneurial and prospector organizations will move to exploit new opportunities, but then either move on, fail, or transform themselves into defender or analyzer organizational forms as the population density in that portion of the niche increases. Organizations inhabiting the shrinking portion of the niche will experience increased competition, and less efficient organizations will exit from that portion of the niche. As the leading edge of the niche shifts making new forms of performance possible, and the trailing edge contracts making forms of past performance less possible, the dynamics of change in the population will continue as a cycle over time. Viewing the population at different points in time would likely show that the major actors within the population had changed.

An example of these dynamics was provided in Brittain and Freeman's (1980) study of the semiconductor industry. As technology advanced from vacuum tubes to large scale integrated semiconductors, the mix of organizations in the population underwent a continuous process of change. New firms emerged or entered into the newly opened regions of the niche. Some of the firms that were leaders in one technology made the transition to the next; others failed or exited as

competition increased in the declining portion of the niche. And as Brittain and Freeman (1980) noted, the leading firms at one phase of the niche's evolution generally were not the same ones that were industry leaders earlier. In essence, continuous evolution in the shape of the niche will result in continuous changes in the composition of the population inhabiting it.

The Continuity of Environmental Change

The phrase "continuity of environmental change" refers to the extent that current conditions within a niche are similar or dissimilar to past niche conditions. In one sense it reflects the rate of environmental change, and it can be portrayed as a continuum ranging from continuous to discontinuous. At one end, the environment undergoes continuous change when states of the environment at different points in time are not qualitatively different. That is, continuous environmental changes are related to environmental trends, which can be defined as "any continuous or continual connection between two or more points of data (DeGreene, 1982: 111)." For example, changing population demographics, an increased level of wealth, shifting consumer preferences, and so on tend to create continuous environmental changes.

The discontinuity end of the continuum reflects situations where niche conditions are qualitatively different at one point in time as compared to the next. Discontinuities are often associated with events, such as the passage of governmental regulations. An example of a series of environmental discontinuities associated with governmental actions that opened, expanded, modified, and then closed a niche over the period of a few years is provided by the history of "casino nights"

and "poker nights" in Colorado.* In 1979, the Colorado legislature passed a bill permiting charities to sponsor seven gambling events in licensed liquor establishments for the purpose of fund-raising. In 1981, additional legislation expanded the law to allow all non-profit organizations in the state to host "casino nights." These legislative actions opened a new niche and then expanded it. Growth of an organizational population in the niche began slowly, then increased at an accelerating rate. Thirty casino operations were active in 1981, 92 in 1982 and 500 by August, 1983. It has been estimated that these operations grossed $25 million during the first eight months of 1983.

Stories began to surface in the Denver newspapers during the spring of 1983 suggesting the possibility that criminal elements had infiltrated casino night operations. Subsequently, concern grew in the Colorado legislature that resulted in an act authorizing the State Liquor Enforcement Agency of the Department of Revenue to police the casino nights. The first action of the Revenue Department's director was to solicit an opinion from the state attorney general on the constitutionality of "casino nights." The attorney general's opinion, issued in August 1983, stated that "casino nights" violated the Colorado constitution's prohibition of games of chance. Casino night operations were closed down a few days later.

A loophole in the attorney general's opinion was that poker and other unspecified games were games of skill and not prohibited by the constitution, thereby allowing non-profit organizations to host "poker nights." The first "poker night" was hosted in October, 1983 and, by December, 27 permits to host "poker nights" had been issued. During

*Data for this example were drawn from Coakley (1984), Kilzer and Weaver (1983), Parmenter (1984), and Sherman (1983a,b).

the first few months of 1984 the number of permits issued grew rapidly: 100 in January, 255 in February, and 431 in March. By March, "poker palaces" sprang up, some of which advertised poker twelve hours a day, seven days a week. The legislature, concerned by the rapid proliferation of "poker nights" and the potential for abuse, passed a bill in April that banned "poker nights" altogether as of July 1, 1984.

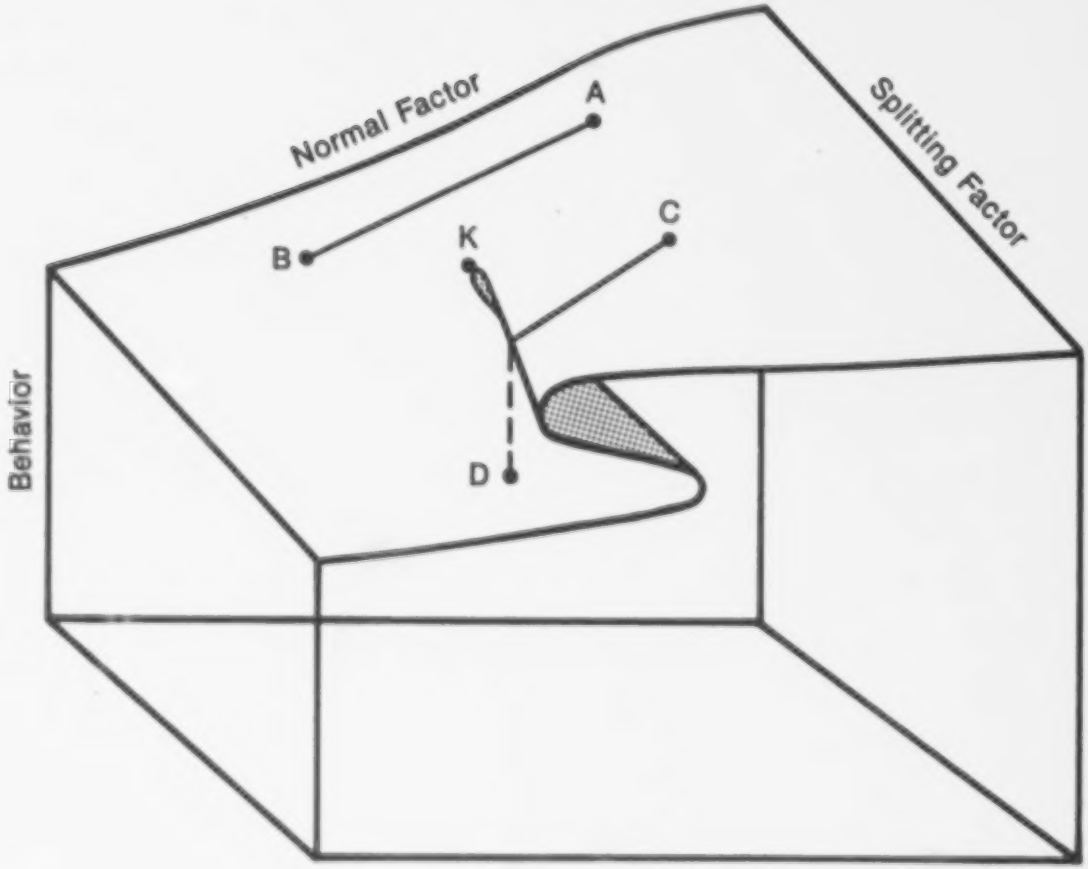
In this example, a series of governmental actions created, expanded, modified, and then closed a niche in a discontinuous manner. In each case, niche conditions were qualitatively different from those preceding them. In the first instance, a niche that had not existed was created. In the second and third instances, governmental actions discontinuously modified that niche by first expanding it and then by banning six of the seven gambling events allowed by the legislation that originally created the niche. In the final instance, governmental actions created another environmental discontinuity when it closed the niche. Activities that were possible on one day were not possible on the next.

Environmental discontinuities also can be trend-related when there are "critical points or ranges, above and below which the system exists in qualitatively different states or may even no longer exist as the same system (DeGreene, 1982: 169)." The central notion is that while changes in the environment may be continuous or trend-like, there are often critical points at which continuous changes have discontinuous effects on the system. For example, interest rates may rise continuously and have little effect on housing demand for housing until rates reach a critical point after which demand decreases rapidly.

Catastrophe theory (Thom, 1975; Zeeman, 1976) is a technique for modeling situations where continuous changes result in discontinuous effects. Originally developed to model such phenomena in the physical and biological sciences, catastrophe theory has been applied to organizational phenomena in recent years (Bigelow, 1982; Ford, 1980a; Sheridan and Abelson, 1983). Figure 3-5 represents a diagram of the cusp-catastrophe model, the most common form used by social scientists in examining divergent social phenomena. The surface is the behavior of the dependent variable of interest, and the fold in the surface reflects the discontinuity property of the model. One axis is labelled the "normal factor" because it is linearly-related with the behavior of interest. The other axis is referred to as the "splitting factor" because it splits the behavior surface into upper and lower regions. For values above the cusp point (K) on the splitting factor, behavior will vary continuously with changes in the value of the normal factor (points A to B). For values below the cusp point on the splitting factor, behavior will vary discontinuously with the normal factor (points C to D).

A couple of simple examples will clarify this idea. For example, Zeeman (1976) suggests that the cusp catastrophe model may provide a useful model for explaining stock market crashes. In this example, the normal factor is excess demand for stock. The splitting factor is the amount of stock held by speculators as opposed to that held by investors. The behavior axis can be defined as an index of stock prices. "A market with some excess demand and a high proportion of speculators is a bull market... A crash can be precipitated by any event that reduces demand enough to push the behavior point over the

Figure 3-5
The Cusp-Catastrophe Model



fold curve. The larger the share of the market held by speculators, the severer the crash (Zeeman, 1976: 77)."

Zeeman (1980) also uses the cusp catastrophe to model changes in inflation. The supply of money is the normal factor; the ability of economy to buffer itself from the effects of changes in the supply of money is the splitting factor. The level of interest rates is the behavior axis. The dynamics of the model suggest that if an economy has little ability to manage the relationship between changes in the money supply and inflation, they will covary in a linear manner. But, the greater the ability of an economic system to buffer from rising interest rates, the more likely that a critical point will exist beyond which a discontinuity will occur and result in hyperinflation.

In sum, catastrophe theory provides a method for formally modeling "situations where gradually changing forces or motivations lead to abrupt changes in behavior (Zeeman, 1976: 65)." The interest here is not in the formal modeling aspects of catastrophe theory, but in the intuitive understanding it provides in explaining how continuous changes in relevant niche dimensions can create qualitatively different environmental conditions over a short period of time.

Regardless of whether an environmental discontinuity is caused by events or trends, they can have an important influence on the observed dynamics in a population of organizations experiencing environmental change. For example, as was noted in a preceding section, the rapidity of change may influence the composition of a population as its niche's size or shape changes. Whether entrepreneurial or prospector organizations appear in or disappear from a population is partially a

function of the extent to which changes in niche size or shape were discontinuous.

Moreover, the continuity-discontinuity continuum is important in explaining differences in managerial perceptions of and responses to environmental change. In the first instance, individuals are more likely to perceive change when abrupt environmental discontinuities occur than when changes are continuous. In the latter case, it also appears that managers are more likely to actively respond to discontinuities as opposed to continuous trends. For example, Schendel and Patton (1976) examined the behavior of 36 matched pairs of firms that had experienced performance downturns. They found that the firm that had experienced the most severe downturn in most of the pairs was more likely to generate and implement successful turnaround strategies. They concluded that "a stagnating or declining company seems to first need a deepened threat or shock to spur it to action. Steadily poor performance so long as it does not develop a crisis seems to be tolerated. Once a crisis arrives, the firm can move into action (Schendel and Patton, 1976: 240)." Similarly, environmental discontinuities often are more likely to be perceived as threatening by managers in an organization than are continuous environmental trends. Both these issues and their affect on the formulation and implementation of strategies for adaptation will be examined in detail in a later chapter.

The thrust of the discussion to this point can be summarized in noting that these two dimensions, changes in niche configuration and the continuity of change, provide a useful way to think about the process of societal evolution in an organizational context. It is

through the continual creation, modification, and closure of niches in the larger social system that a large part of the evolutionary process occurs. To complete the quote from Boulding (1978: 18) presented at the beginning of this chapter, "the pattern jogs along in an immensely complex interaction of things, organizations, and people, with biological, meteorological, and geological environments, structures and populations."

Moreover, these two dimensions can be used to construct a model of niche conditions that characterize types of environments that organizations may pass through over a period of time. The model has three important aspects. First, it provides a devise for understanding how dynamics vary within populations that encounter different niche conditions. In essence, it can be used to explore questions concerning how and why changes occur in competition within a population, how such changes differentially affect the survival and failure of organizations within it, and subsequently change the composition of the population over time.

Second, the model can be used to examine why organizations within the same population select different strategies for responding to changing environmental conditions. Unlike many other models of adaptation, the one presented in the following sections focuses on the relative position of an organization within the population niche. Drawing on the concepts of niche breadth and overlap discussed in Chapter 2, it becomes possible to gain insight into the reasons why a variety of strategies can be successfully pursued by organizations within the same population. It also becomes possible to understand why

organizations in different populations pursue fundamentally different strategies in response to similar types of environmental conditions.

Third, when the model is viewed over a long period of time it becomes reasonably easy to see that populations of organizations pass through a series of environmental states over time. The implication is that strategies successfully pursued under one set of niche conditions may be inappropriate later under a different set of conditions. As a result, it is expected that through a combination of strategic choice and natural selection processes, the composition of a population will change and that "winners" at one point may be "losers" at the next. A nice example of this was provided by Business Week in an 1984 examination of the firms Peters and Waterman cited as the best managed in America in their 1982 book, In Search of Excellence. Of the 43 firms Peters and Waterman listed, Business Week noted that 14 were suffering severe problems in 1984. "Of the 14 excellent companies that had stumbled, 12 were inept at adapting to a fundamental change in their markets ('Who's excellent now?' 1984)." Strategies that had been remarkably successful in the 1970s failed in the 1980s.

The following section describes the different types of environmental conditions suggested by combining the two dimensions discussed above. Chapter 4 uses this model to examine variations in population dynamics that are likely under the different niche conditions. Then Chapter 5 focuses on why there are variations in organizational responses to these conditions within populations of organizations.

A MODEL OF NICHE CONDITIONS

The two dimensions, changes in niche configuration and continuity of change, can be combined with a third dimension, whether changes in a niche are condusive to population growth or decline, to create an eight-cell model of environmental conditions. One aspect of this model different from others in the literature is that the addition of the third dimension allows issues of organizational growth and decline to be explicitly examined within the same framework. The basic model is shown in Figures 3-6 and 3-7. Figure 3-6 presents the four-cells in which changes in niche shape and size make population growth possible. Figure 3-7 presents four types of changes in niche size and shape that can lead to population decline. The diagrams to the right of the rows in each figure provide a graphic representation of the type of change in niche size or shape being discussed.

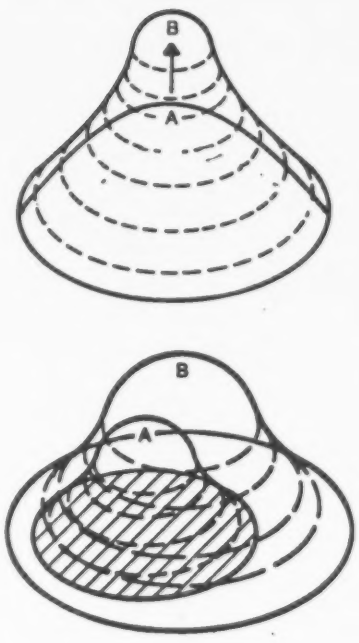
Niche Conditions Condusive to Growth

The four cells in Figure 3-6 represent four types of niche conditions that are condusive to population growth. They are considered as such because, in each case, they represent the enlargement of a niche from time 1 to time 2 in either size or shape. The upper-left cell is labelled expansion and portrays a situation where there is a continuous increase in the size of a population's niche. The expansion of a niche means that the level of performance the niche will support increases continuously while the types of performance possible remain fundamentally the same over a period of time. For example, growth in the demand for electrical power grew

Figure 3-6

NICHE CONDITIONS CONDUSIVE TO GROWTH

Type of Change in Niche Configuration	Continuity of Change: Continuous	Continuity of Change: Discontinuous
Change in Niche Size	EXPANSION	ERUPTION
Change in Niche Shape	EVOLUTION	CREATION



approximately seven percent annually through the 1950s and 1960s, which provided a steady expansion of the niche of electric utilities.

The upper-right cell is labelled eruption, and represents the situation where there is a discontinuous increase in the size of a population's niche. As was the case for expansion, the types of performance the niche will support remains constant, but the increase in niche size occurs discontinuously. For example, college and university enrollments, which had been depressed during World War II with the entry of most able-bodied men into the armed services, increased discontinuously after the end of the war. Returning veterans who took advantage of the GI bill enrolled in substantial numbers upon discharge from the military. The result was an eruption of demand for the services of colleges and universities.

The lower-left cell is labelled evolution and represents a continuous evolution in the shape of a niche. The evolution of niche shape means an expansion in the types of performance the niche will support. And this expansion is typically accompanied by an increase in overall niche size. The early history of the personal computer industry provides a good example of this niche condition. The introduction of the first personal computer by Apple opened the niche. As new technology and applications were brought to market, both the size and shape of the industry's niche were expanded.

The lower-right cell has been labelled creation, which refers to a discontinuous enlargement of niche shape. This condition can occur through the discontinuous expansion of an existing niche, or it can reflect the discontinuous creation of a new niche. In the first instance, the introduction of the IBM PC in 1982 resulted in a

discontinuous expansion of the personal computer industry niche by opening up new areas of performance that the industry niche would support. In the latter instance, niches are often discontinuously created through governmental actions. The creation of "casino nights" in Colorado discussed earlier is an example of this phenomenon.

Niche Conditions Condusive to Decline

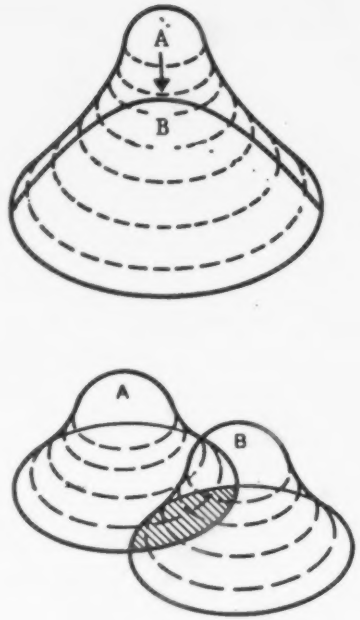
The four cells in Figure 3 7 present four types of niche conditions that are condusive to population decline. They differ from the conditions discussed above in that they represent a contraction in the size or shape of a niche from time 1 to time 2. The upper-left cell is labelled erosion, where there is a continuous decrease in the size of a population's niche. The forms of performance that the niche will support remain much the same over time, but the level of performance possible in the niche undergoes a continuous decrease. For example, the niche of the baby food industry underwent a period of erosion between the late 1950s and the early 1970s. A gradual decline in the number of births in the United States during this period caused a subsequent continuous decline in the demand for baby food.

The upper-right cell is labelled contraction, which is the situation where changing environmental conditions bring about a discontinuous decrease in the size of a niche. As was the case for erosion, the types of performance that the niche will support remains relatively stable while there is a discontinuous decrease in the level of performance the niche will support. For example, the U.S. automotive industry experienced a discontinuous decrease in the size of the industry niche between 1980 and 1982. Turmoil in Iran, rising oil

Figure 3-7

NICHE CONDITIONS CONDUSIVE TO DECLINE

Type of Change in Niche Configuration	Continuity of Change: Continuous	Continuity of Change: Discontinuous
Change in Niche Size	EROSION	CONTRACTION
Change in Niche Shape	DISSOLUTION	COLLAPSE



prices, and increased consumer uncertainty resulted in a rapid decrease in demand for automotive products during this period.

The lower-left cell represents the condition of dissolution, where the shape of a niche undergoes a continuous shift. In this situation, the niche gradually evolves away from its earlier shape, making new forms of performance possible and either disallowing old forms of performance or making them less possible. For example, the niche of the college and university population is undergoing a period of dissolution that began in the late 1960s as students' interests in fields of study began to shift. Interest in the liberal arts and sciences decreased substantially while student interest in professional fields of study and the applied sciences increased significantly.

The lower-right cell is labelled collapse, and represents the situation where there is a discontinuous shift in the shape of a niche. As was the case for dissolution, the shift in niche shape makes some forms of performance less possible while making new forms of performance possible. For example, the Swiss watch industry underwent a period of collapse during the mid-1970s. The introduction of electronic watches by American semiconductor manufacturers, a high level of consumer acceptance of these products, and a rise in the value of the Swiss franc resulted in a precipitous decline in the demand for the mechanical watches produced by Swiss manufacturers.

It should be kept firmly in mind that all eight of these cells represent categorizations of environmental phenomena that are, in reality, continuous in nature. The distinction between changes in niche size and in niche shape have been treated independently when they can and do occur simultaneously. Similarly the continuity of change in

a continuum; some changes are more continuous than others and vice versa. Moreover, it is readily apparent that the figures depicting changes in niche size and niche shape present only a few of the possible configurations of change that might actually occur. Even though this categorization scheme is somewhat crude, it will be shown in the next two chapters to provide a useful framework for thinking about the process of adaptation at the population and organization levels of analysis.

Chapter 4: Outline

ADAPTATION OF ORGANIZATIONAL POPULATIONS

The purpose of this chapter is to apply the framework presented in Chapter 3 to an analysis of the impact of changing niche conditions on populations of organizations. The effects of changing niche conditions on competition among organizations within a population, and the success and failure of different types of organizations are examined. These dynamics then are illustrated with a series of industry-level case studies. The following section briefly describes these dynamics and identifies the industries that will be used for illustrative purposes.

Conditions of Growth

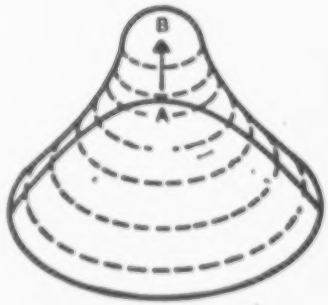
Table 4-1 presents a summary of the expected population dynamics under the four types of environmental conditions that are condusive to population growth. Generally, competition is either decreased or remains much the same as niches expand in size or shape. Organizational failures under environmental conditions condusive to growth tend to be randonly distributed throughout the population. That is, environmental selection pressures operate infrequently if at all under these conditions, and failures within the population tend to be due more to inept management than competitive pressures. While failures may be random, the type of organizations that do best under each condition varies according to whether niche expansion is due to changes in niche size or shape and with the extent to which these changes are continuous or discontinuous.

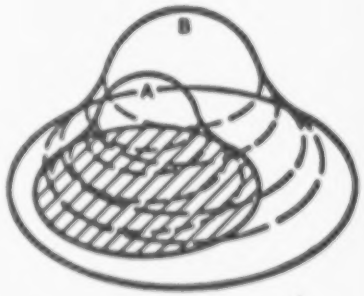
Expansion. The continuous increase in niche size has been labelled expansion because it describes a condition where there is a

Figure 4-1

POPULATION DYNAMICS IN NICHE CONDITIONS CONDUSIVE TO GROWTH

Type of Change in Niche Configuration	Continuity of Change: Continuous	Continuity of Change: Discontinuous
Change in Niche Size	**Expansion** Competition: No increase Success: Defenders, analyzers Failure: Random	**Eruption** Competition: Decreases Success: All types Failure: Random
Change in Niche Shape	**Evolution** Competition: No increase Success: Defenders and analyzers in A, slow to moderate entry of and success of entrepreneurs and prospectors in B. Failure: Random	**Creation** Competition: Decreases Success: Defenders and analyzers in A, rapid entry and success of entrepreneurs and prospectors in B.





continuous increase in the carrying capacity of the population niche. Defenders and analyzers are expected to do best when they can expand their operations to keep pace with the expansion of the niche. Competition will remain relatively constant as long as the organizations within the niche expand their operations in pace with the rate of niche expansion. If this situation occurs, it is difficult for entrepreneurs and prospectors to enter a relatively mature population. If the organizations within the existing population expand more slowly than the rate of increase in niche size, opportunities will be created for the entry of new organizations, which are most likely to be entrepreneurs and prospectors. (Example: the growth in demand for electricity and the expansion of electric utility operations, 1950-1970.)

Eruption. The discontinuous increase in niche size has been labelled eruption because the term reflects a rapid discontinuous increase in the carrying capacity of the population niche. A discontinuous increase in the size of a population niche will benefit entrepreneur and prospector organizations most because it creates the conditions necessary for their entry into a niche. Competition within the population will decrease as the density of the population decreases, but then increase as density increases with the entry of new organizations. (Example: the GI bill and higher education, 1946-1951.)

Evolution. The continuous change in niche shape represents a situation where the population niche continuously evolves to make possible more forms of performance. Continuous changes in the shape of a niche which result in the ability of the population to perform in new

ways will favor analyzer organizations most if the rate at which the niche evolves is relatively slow and new performance opportunities are not radically different than old ones. Competition among organizations in the niche will vary, being more intense in the most densely occupied parts of the niche, and lessening in the newly evolving parts of the niche. If the pace at which the niche evolves is relatively quick, opportunities for both entrepreneur and prospector organizations are created, and they will have a relative advantage over defenders and analyzers in the newly evolved portions of the population niche. (Example: technological innovation and the home computer industry, 1976-1981).

Creation. Discontinuous changes in the environment act to rapidly expand the possible forms of population performance. Such discontinuities in niche shape will result in major opportunities for the creation of entrepreneur and prospector organizations that can move quickly to exploit the new created portions of the niche. Defenders, in particular, will be at somewhat of a disadvantage because of the rapid evolution of the performance characteristics that the niche will support can leave them in the "back waters" of the industry. The level of competition will be relatively low in this situation, until the density of new organizations in the evolving portion of the niche increases significantly. (Example: introduction of the IBM PC and the creation of an IBM-compatible home computer industry, 1981-1984.)

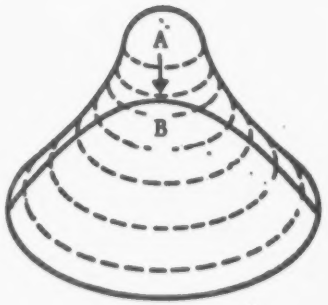
Conditions of Decline

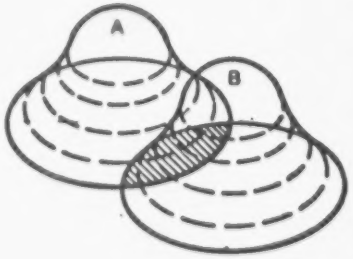
Table 4-2 presents a summary of the expected population dynamics under the four types of environmental conditions that are condusive to population decline. Generally, decline conditions increase competition

Figure 4-2

POPULATION DYNAMICS IN NICHE CONDITIONS CONDUSIVE TO DECLINE

Type of Change in Niche Configuration	Continuity of Change: Continuous	Continuity of Change: Discontinuous
Change in Niche Size	**Erosion** Competition: Slow increase Success: Defenders, analyzers Failure: Slow increase in the failure of entrepreneurs and prospectors	**Contraction** Competition: Rapid increase Success: Defenders Failure: Rapid increase in the failure of entrepreneurs and prospectors, likely exit of analyzers
Change in Niche Shape	**Dissolution** Competition: Slow to moderate increase in A; low level in B Success: Defenders and analyzers in A; analyzers, prospectors and entrepreneurs in B Failure: Slow to moderate increase in failures of entrepreneurs and prospectors in A; random in B	**Collapse** Competition: Focus of competition shifts to between inhabitants of A and B Success: Defenders in A; analyzers, entrepreneurs, and prospectors in B Failure: Rapid increase in failures of all types in A; random in B





within a population niche by increasing population density. When these changes are related to reductions in niche size, defender and analyzer will outperform entrepreneurs and prospectors. But when changes are related to changes in niche shape, opportunities are available for the entry of entrepreneurs and prospectors into the evolving portions of the niche, while competition and attrition of inefficient organizations in the declining portion of the niche will rise.

Erosion. Continuous decreases in niche size reduce the carrying capacity of the population niche. Defenders and analyzers will do best in this situation as their economies of scale enable them to compete effectively as the size of the population niche decreases. Competition will increase slowly, and failures will increase for entrepreneur and prospector organizations. (Example: the declining birthrate and the baby food industry, 1961-1975.)

Contraction. Discontinuities in the environment result in a discontinuous reduction in the carrying capacity of a population niche, which will result in a significant increase in competition among organizations within the population. Defenders will have a competitive advantage over the other types of organizations because of their economies of scale in production as compared to other types of organizations. Entrepreneurs and prospectors will be the most likely to fail in this situation followed by analyzers. (Example: uncertainty surrounding gasoline supplies and the recession's effects on the U.S. automotive industry, 1979-1982.)

Dissolution. Continuous change in the shape of a niche results in a transition where new forms of organizational performance are required to survive. Analyzer organizations will have a competitive advantage

over defender organizations because of the relative breadth of their domains, which provides more performance options to the analyzer than are available to the defender. Competition will increase moderately in the "old" portion of the niche as it evolves into a new configuration. If the niche evolves slowly and new performance characteristics are not radically different from earlier ones, the entry of entrepreneur and prospector organizations into the population is not likely. (Example: changing student interests in fields of study and liberal arts colleges, 1970-1980.)

Collapse. Discontinuous changes in the shape of a niche result in a rapid transformation of the forms of performance are possible. Organizations within the population have to substitute new forms of performance to survive the transition. A discontinuous change in the shape of a population's niche that results in a rapid change in the types of performance the niche will support will favor entrepreneurs and prospectors over defenders and analyzers since they are more likely to move quickly to exploit the rapidly evolving niche. Competition will decrease in the original niche as organizations fail and increase between the occupants of what remains of the old niche and the occupants of the newly evolved niche. (Example: the electronic watch and the Swiss watch industry, 1972-1978.)

Chapter 5: Outline

ADAPTATION AND INDIVIDUAL ORGANIZATIONS

This chapter examines how individual organizations respond to the different types of niche conditions presented in the model of environmental change. The organizational responses considered in this chapter are concerned primarily with how organizations manipulate their domains of operation. Moreover, this chapter addresses the question of why organizations within the same population often choose different types of domain strategies. The expected domain strategies employed by organizations encountering the various niche conditions are displayed in Table 5-2. Case materials for firms drawn from the industries discussed in Chapter 4 will be used in a later draft to illustrate the model.

Domain Strategies

An organizational domain was defined in Chapter 2 as the locale within the population niche in which an organization chooses to operate. An organization's domain is defined by the range of its products, customers, and services. A domain strategy refers to the types of actions in which an organization engages to manipulate its domain. Table 5-1 presents a broad categorization of different types of domain strategies and a number of subclassifications that reflect how the overall domain strategies are accomplished. The major classifications are: 1) domain continuity, 2) domain defense, 3) domain offense, 4) domain creation, and 5) domain abandonment.

Domain continuity is the maintenance of an existing organizational domain within which organizations expand or reduce their ability to

Table 5-1

A Classification of Domain Strategies

1. Domain Continuity: Maintaining the existing organizational domain while focusing on operational issues within it.

2. Domain Defense: Creating and maintaining the legitimacy and autonomy of the existing organizational domain.

3. Domain Offense: Enhancing economic performance by modifying existing products/markets into or out of "adjacent" areas within the population niche.

    a) Domain Offense: Expansion into new areas of products/markets that are adjacent to the existing organizational domain. The intent is to enhance the organization's ability to exploit resources and demand within the existing population niche.

    b) Domain Consolidation: Contraction of existing areas of operation to the core expertise of the organization. Generally, this strategic option is seen as paring away peripheral activities in which the organization engages so that resources and attention can be devoted to performing efficiently the activities at which the organization is best.

4. Domain Creation: Developing of new performance opportunities for the organization through the creation of new domains.

    a) Domain Creation: Internal generation of new performance opportunities through discovery and innovation.

    b) Domain Addition: Diversification of organizational performance through acquisition or merger.

    c) Domain Substitution: The substitution of one domain for another, often through acquisition or merger.

5. Domain Abandonment: Exiting a current domain, typically through divestment.

operate. The domain defense refers to actions aimed at creating and maintaining the legitimacy and autonomy of an organization within its selected domain. Domain offense strategies emphasize enhancing the performance of the organization by modifying its existing products or markets into or out of "adjacent" areas within the population niche. Domain creation refers to the development of new performance opportunities for an organization through the creation or addition of new areas of activity. Finally, domain abandonment refers to situations where an organization abandons its domain of activity. This strategy applies primarily to organizations that participate in many domains (i.e., multi-industry or conglomerate firms). As can be seen in Table 5-1, there are a number of subcategories for the domain offense and domain creation strategies that differentiate among different methods for achieving the above domain strategies.

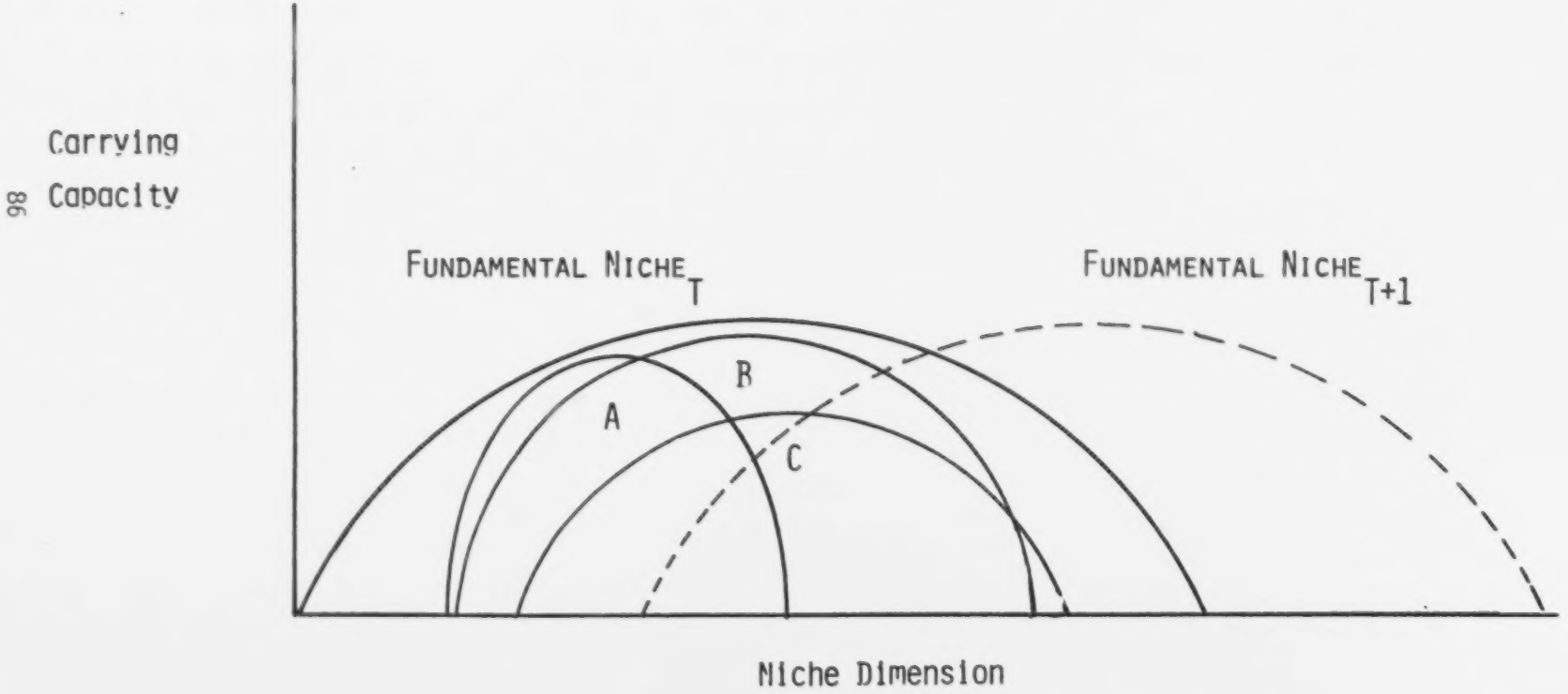
"Local Effects" in Population Niches

The second topic to be addressed in this chapter is why organizations within the same population will choose different strategies in responding to changing environmental conditions. The reason is that organizations will differentially experience changing niche conditions, depending where they are within the niche. In effect, the locale of an organization within its niche (i.e., where it has selected to operate as defined by its domain) is a major factor in determining how the organization experiences the changes affecting the whole population.

In industries where organizational domains exhibit a high degree of overlap, the overlapping organizations will experience changing niche conditions in much the same manner. For example, Figure 5-1

Figure 5-1

"Local Effects" in an Evolving Niche
Homogeneous Population



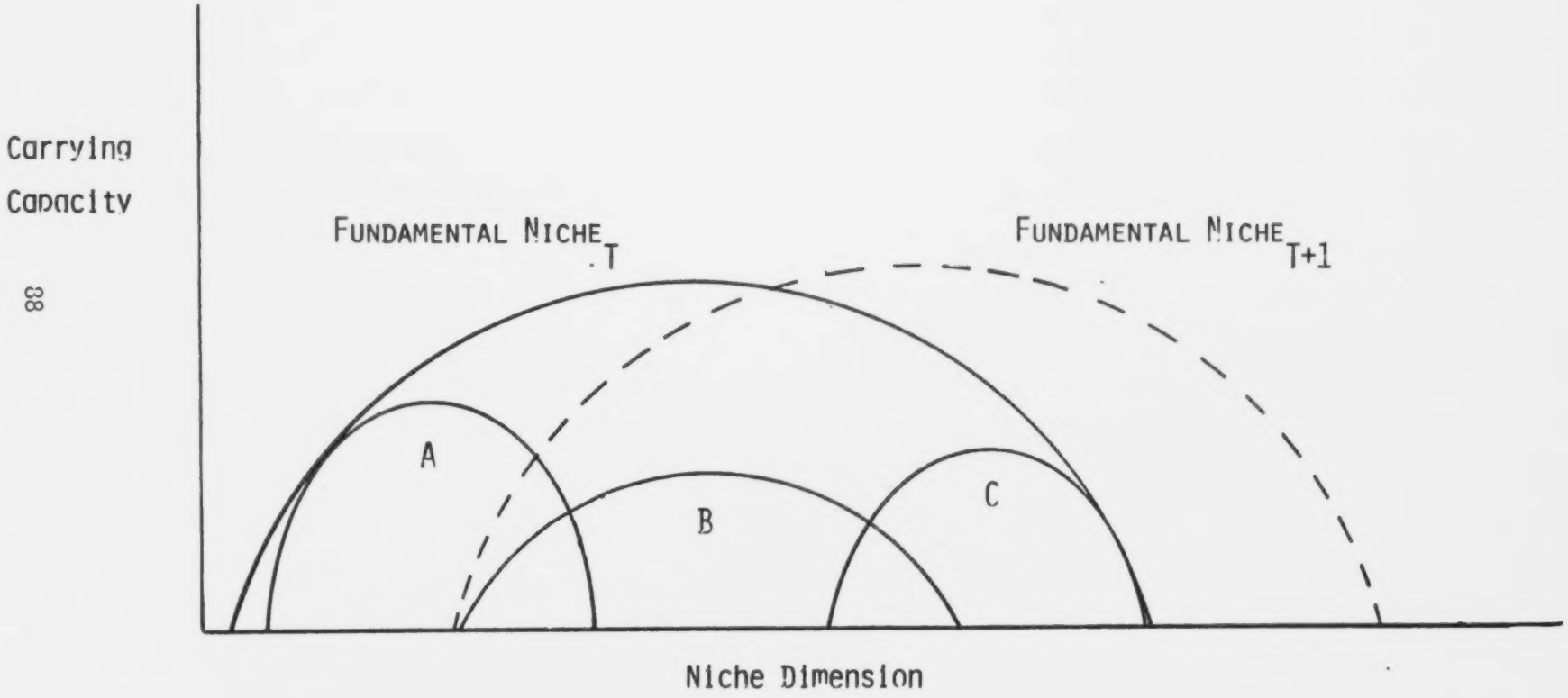
illustrates the impact of a shifting niche shape on a population of three organizations. The vertical axis represents the niche's carrying capacity, while the horizontal axis represents the particular niche dimension along which the organizations are distributed. Curves A, B, and C represent the domains of three organizations along that niche dimension, and these curves exhibit a high degree of overlap. The large solid curve represents the configuration of the population niche at time 1 and the large hatched curve represents the population niche at time 2. As the population niche shifts from time 1 to time 2, it would be expected that the three organizations within the population experience changing environmental conditions in much the same way given the high degree of overlap in their domains. If this is a continuous shift, according to the model all three organizations will experience the condition of dissolution. As a result, it is likely that all three organizations would consider and select similar strategies for adapting to changing environmental conditions.

In contrast, organizations in populations where there is a low degree of overlap among organizational domains are likely to differentially experience changing niche conditions. Figure 5-2 represents this situation. These three organizations are likely to engage in different domain strategies as the population niche shifts from time 1 to time 2 because they are affected differently by the changing environmental conditions. If this was a continuous change in niche shape, Organization A would locally experience a relatively severe case of dissolution, Organization B would locally experience environmental erosion, while Organization C would locally encounter a condition of niche evolution. Given the differences in the manner in

Figure 5-2

"Local Effects" in an Evolving Niche

Heterogeneous Population



which these organizations experience their local environment, it is logical to assume that they will engage in strategies designed to deal with those specific conditions. As a result, it is generally expected that the less the degree to which the domains of organizations in a population overlap, the greater the diversity of strategies that will be evident within a population as niche conditions change.

Organizational Responses to Complexly Changing Environments

The following section outlines the types of modal domain strategies and operational emphases that would be expected on the part of organizations encountering the eight different types of environmental conditions. These responses are labelled modal responses in that they are only one of a number of strategies that might be successfully pursued under the different conditions. The full draft of this chapter will discuss counter or alternative strategies and why they can be used successfully in adapting to changing conditions for a limited portion of a population.

Table 5-2 presents a summary of the types of operational emphases and domain strategies that would be expected to be exhibited by the majority of organizations encountering each type of niche condition. The term "operational emphasis" is meant to connote the overall purpose for engaging in the different types of domain strategies or, in essense, how the domain strategy addresses the environmental condition encountered.

With respect to the conditions condusive to population growth, increases in niche size are likely to elicit a response of domain continuity from organizations, and be accompanied by an operational emphasis on the expansion of production capacity. When increases in

Table 5-2

A Model of Environmental Change and Organizational Response

Expansion OE: Controlled growth DS: Continuity	Eruption OE: Rapid expansion of capacity DS: Continuity

Evolution OE: Domain diversification through innovation DS: Creation	Creation OE: Domain diversification through acquisition DS: Addition

Erosion OE: Fine-tuning DS: Offense	Contraction OE: Retrenchment DS: Defense and consolidation

Dissolution OE: Search for new alternatives DS: Defense, then creation	Collapse OE: Experimentation DS: Substitution

OE = Operational Emphasis

DS = Domain Strategy

niche size are continuous, this is likely to be controlled growth. When these increases are discontinuous, efforts are likely to be oriented toward rapid expansion of capacity through short term actions (e.g., leasing plant rather than constructing it, subcontracting rather than doing the work itself, etc.)

In situations where there is an expansion in the shape of a niche is experienced, it is likely that a majority of the organizations will attempt to track new performance alternatives by expanding their domains. When expansion in niche shape is continuous, organizations often have time to engage in domain creation strategies through research and development. When expansions in niche shape are discontinuous, many organizations will attempt to expand their domains into the opening portions of the niche by adding of new performance capabilities, often through acquisition rather than research and development.

With respect to niche conditions condusive to population decline, organizations confronted with an erosion in niche size will emphasize domain offense strategies that allow them to more thoroughly exploit the smaller niche. Such domain activities are usually accompanied by fine-tuning of the organization's core domain in order to increase efficiency. When a reduction in niche size is discontinuous, organizations are more likely to engage in domain consolidation and dispose of peripheral operations in order to increase efficiency. This process usually means that the organization undergoes a period of retrenchment as it reduces the scope of its operations.

When organizations experience the condition of dissolution, they usually attempt to track changes in the shape of the niche by engaging

in domain creation activities. This allows them to search for new performance alternatives to supplement those that are becoming less viable as the shape of the niche changes. Finally, organizations confronted with discontinuous shifts in niche shape usually engage in domain substitution strategies that will replace the organizations' existing domains. The need for quick action created by a discontinuity often requires that organizations experiment with new domains in the hope of finding ones supported by the new niche configuration.

Overall, it is expected that there will be a high degree of similarity in the strategies selected by organizations in homogeneous populations because they experience essentially the same local niche conditions. But in heterogeneous populations, a variety of strategies is more likely because the local conditions experienced by organizations within the population will be different, depending on the location of each organization's domain within the niche.

Chapter 6: Outline

ORCHESTRATING STRATEGIC ADAPTATION: THE ROLE OF INTERPRETIVE STRATEGY

This chapter examines the role of individuals in formulating and implementing strategic organizational responses to changing environmental conditions. The chapter will focus on two topics: 1) the impact of perceptions of environmental change and attributions of the causes of change on strategy formulation, and 2) the role of organizational leaders in creating an internal environment within which effective strategies can be formulated and implemented. The outline of this chapter is necessarily less detailed than the first five because the research on which it will be based is currently in progress.

Perception and Attribution

It is evident that the manner in which individuals perceive environmental conditions has an impact on the types of strategies that they select for their organizations. Similarly, different attributions about the causes of environmental conditions will determine what strategies are seen as being potentially effective. A classic example of these points is the perceptions of and strategic responses to changing environmental conditions by executives in the Big Three automotive manufacturers during the 1973-74 oil embargo (Zammuto, 1982). Executives at GM believed that the oil embargo was indicative of fundamental changes in the global economy; executives at Ford and Chrysler believed that the oil embargo was an aberration that would disappear shortly. As a result of these perceptions, GM embarked on a major product redesign effort; Ford and Chrysler conducted business as

usual. The effect of these strategic choices was that GM gained more than two years on its domestic competitors in downsizing its automotive products. Chrysler was severely weakened by its strategy, which contributed to its near brush with bankruptcy during the late 1970s and early 1980s.

Research is currently being conducted by the Organizational Studies Division to enhance our understanding of how perceptions and attributions systematically affect the selection of strategies. Part of this work is based on a model developed by Ford (1984). Ford's model focuses on issues such as the role an organization's past history and the commonality of its experiences with other organizations in forming perceptions and attributions about changing environmental conditions. The model then examines the role of these perceptions and attributions as moderators in the selection of strategy.

Coupled with an extensive review of the literature, this research will provide the information necessary to construct an overall set of hypotheses about the role of perception and attribution in the strategy selection process. This aspect of theoretical development is important to the overall adaptation project. Eventhough it is possible to specify a set of modal and counter strategies that logically address environmental pressures for adaptation, the histories of many firms and industries show that organizations do not necessarily respond in a logical manner. This research should help explain why.

The Role of Interpretive Strategy

The concept of interpretive strategy is largely drawn from the work of Chaffee (1983, 1984, 1985). Interpretive strategy consists of orienting metaphors constructed to conceptualize and guide the

attitudes and beliefs of organizational participants. This strategic model assumes that organizational reality is socially constructed, and that motivation, not information, is the critical factor in achieving adequate strategic behavior.

Given this orientation, the concept of interpretive strategy plays an important role in the overall model of adaptation being developed in this manuscript. Interpretive strategy is the process by which organizational leaders construct a social reality about the organization and its environment in a manner that pulls together diverse organizational constituencies. Eliminating or managing diverse perspectives is an important component in the formulation and implementation of effective strategic responses to changing niche conditions.

Research is currently being conducted by the Organizational Studies Division to supplement Chaffee's earlier work on the role of interpretive strategy in recovering from decline. The results of this case study and questionnaire research will broaden our understanding of the role of interpretive strategy in a variety of environmental conditions, ranging from growth to decline.

Chapter 7: Outline

CONCLUSION

This chapter will summarize the major points developed in the preceding chapters, and focus on tying together the insights developed about the relationships of environments, organizations, and individuals in the adaptation process.

REFERENCES

Aldrich, H. Organizations and environments. Englewood Cliffs, N.J.: Prentice-Hall, 1979.

Astley, W. G. and Van de Ven, A. H. "Central perspectives and debates in organization theory," Administrative Science Quarterly, 1983, 28, 245-273.

Bigelow, J. "A catastrophe model of organizational change," Behavioral Science, 1982, 27, 26-42.

Boulding, K. Ecodynamics: A new theory of societal evolution. Beverly Hills, Calif.: Sage, 1978.

Brittian, J. W. and Freeman, J. H. "Organizational proliferation and density dependent selection," in J. R. Kimberly and R. H. Miles (Eds.), The organizational life cycle. San Francisco: Jossey-Bass, 1980.

Burns, T. and Stalker, G. M. The management of innovation. London: Tavistock, 1961.

Chaffee, E. E. Case studies in college strategy. Boulder, Colorado: National Center for Higher Education Management Systems, 1983.

Chaffee, E. E. "Successful strategic management in small private colleges," Journal of Higher Education, 1984, 55, 212-241.

Chaffee, E. E. "Three models of strategy," Academy of Management Review, 1985, 10.

Child, J. "Organizational structures, environment, and performance--the role of strategic choice," Sociology, 1972, 6, 1-72.

Coakley, T. "Poker becomes ace in hole for state non-profit groups," Denver Post, March 25, 1984, 1-A, 4-A.

Colwell, R. K. and Futuyma, D. J. "On the measurement of niche breadth and overlap," Ecology, 1971, 52, 567-576.

DeGreene, K. B. The adaptive organization: Anticipation and management of crisis. New York: Wiley, 1982.

Dill, W. R. "Environment as an influence on managerial autonomy," Administrative Science Quarterly, 1958, 2, 409-443.

Eighmy, J. L. and Jacobsen, R. B. "Extension of niche theory in human ecology: Three patterns of niche occupation," American Ethnologist, 1980, 7, 286-299.

Elton, C. S. Animal ecology. London: Sidgwick and Jackson, 1927.

Evan, W. M. "Toward a theory of interorganizational relations," Management Science, 1965, 11, B217-B230.

Ford, J. D. "The occurrence of structural hysteresis in declining organizations," Academy of Management Review, 1980, 5, 589-598.

Ford, J. D. "The role of causal attributions in decision makers' responses to performance downturns," mimeo, Ohio State University, 1984.

Fouraker, L. F. and Stopford, J. M. "Organizational structure and the multinational strategy," Administrative Science Quarterly, 1968, 13, 47-64.

Freeman, J., Carroll, G. R., and Hannan, M. T. "The liability of newness: Age dependence in organizational death rates," American Sociological Review, 1983, 48, 692-710.

Gause, G. F. The struggle for existence. Baltimore: Williams and Wilkins, 1934.

Grinnell, J. The niche relationships of the California thrasher," Auk, 1917, 21, 364-382.

Hannan, M. T. and Freeman, J. "The population ecology of organizations," American Journal of Sociology, 1977, 82, 929-964.

Hardin, G. "The competitive exclusion principle," Science, 1960, 131, 1292-1297.

Hutchinson, G. E. "Concluding remarks," Cold Spring Harbor Symposium on Quantitative Biology, 1957, 22, 415-427.

Kilzer, L. and Weaver, N. "Casino nights ruled illegal," Denver Post, August 6, 1983, 1-A, 4-A.

Lawrence, P. F. and Dyer, D. Renewing American industry. New York: Fee Press, 1983.

Lawrence, P. R. and Lorsch, J. W. Organization and environment. Homewood, Ill.: Irwin, 1969.

Levine, S. and White, P. E. "Exchange as a conceptual framework for the study of interorganizational relationships," Administrative Science Quarterly, 1961, 5, 583-601.

Levins, R. Evolution in changing environments: Some theoretical explorations. Princeton, N.J.: Princeton University Press, 1968.

Lotka, A. J. Elements of physical biology. Baltimore: Williams and Wilkins, 1925.

MacArthur, R. H. and Wilson, E. O. The theory of island biogeography. Princeton, N.J.: Princeton University Press, 1967.

McKelvey, B. Organizational systematics. Berkeley, Calif.: University of California Press, 1982.

McPherson, M. "An ecology of affiliation," American Sociological Review, 1983, 48, 519-532.

McWhinney, W. H. "Organizational form, decision modalities and the environment," Human Relations, 1968, 21, 269-281.

Miles, R. H. and Cameron, K. S. Coffin nails and corporate strategies. Englewood Cliffs, N.J.: Prentice-Hall, 1982.

Miles, R. E. and Snow, C. C. Organizational strategy, structure, and process. New York: McGraw-Hill, 1978.

National Center for Education Statistics. Digest of education, 1980 edition. Washington, D.C.: Government Printing Office, 1980.

Normann, R. "Organizational innovativeness: Product variation and reorientation," Administrative Science Quarterly, 1971, 16, 203-215.

Parmenter, C. "Greed deals charity poker games a busted flush," Denver Post, April 15, 1984, 1-E, 6-E.

Pfeffer, J. and Salancik, G. R. The external control of organizations. New York: Harper & Row, 1978.

Pianka, E. R. "On r- and K-selection," American Naturalist, 1970, 104, 592-597.

Pianka, E. R. Evolutionary ecology. Third edition. New York: Harper & Row, 1983.

Schendel, D. E. and Patton, G. R. "Corporate stagnation and turnaround," Journal of Economics and Business, 1976, 28, 236-241.

Sheridan, J. E. and Abelson, M. A. "Cusp catastrophe model of employee turnover," Administrative Science Journal, 1983, 26, 418-436.

Sherman, S. "Casino nights bill approved by panel," Denver Post, May 6, 1983a, ???.

Sherman, S. "Gaming curbs left to agency," Denver Post, May 18, 1983b, ???.

Snow, C. C. and Hrebiniak, L. "Strategy, distinctive competence, and organizational performance," Administrative Science Quarterly, 1980, 25, 317-336.

Starbuck, W. H. "Organizations and their environments," in M. D. Dunnette (Ed.), Handbook of industrial and organizational psychology. Chicago: Rand-McNally, 1976, 1069-1123.

Starbuck, W. H. and Dutton, J. M. "Designing adaptive organizations," Journal of Business Policy, 1973, 3(4), 21-28.

Stinchcombe, A. L. "Social structure and organizations," in J. G. March (Ed.), Handbook of organizations. Chicago: Rand-McNally, 1965, 142-193.

Thom, R. Structural stability and morphogenesis. Reading, Mass.: Benjamin, 1975.

Thompson, J. D. Organizations in action. New York: McGraw-Hill, 1967.

Tosi, H., Aldag, R., and Storey, R. "On the measurement of the environment: An assessment of the Lawrence and Lorsch environmental uncertainty subscale," Administrative Science Quarterly, 1973, 18, 27-36.

Vandermeer, J. H. "Niche theory," Annual Review of Ecology and Systematics, 1972, 3, 107-132.

Volterra, V. "Fluctuations in the abundance of a species considered mathematically," Nature, 1926, 188, 558-560.

Weick, K. E. The social psychology of organizations. Addison-Wesley, 1969.

Zammuto, R. F. Assessing organizational effectiveness: Systems change, adaptation, and strategy. Albany NY: SUNY Press, 1982.

Zammuto, R. F. Bibliography on decline and retrenchment. Boulder, Colorado: National Center for Higher Education Management Systems, 1984a.

Zammuto, R. F. Characteristics of enrollment competition in higher education. Boulder, Colorado: National Center for Higher Education Management Systems, 1984b.

Zammuto, R. F. and Cameron, K. S. "Environmental decline and organizational response," in L. L. Cummings and B. M. Staw (Eds.), Research in Organizational Behavior, 1985, 7,

Zeeman, E. C. "Catastrophe theory," Scientific American, 1976, 234, 65-83.

Zeeman, E. C. "Catastrophe models in administration," paper presented at the Association for Institutional Research meeting, Atlanta, April, 1980.

Zemsky, R. and Oedel, P. The structure of college choice. New York: College Entrance Examination Board, 1983.